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March 2, 1911.

# American Machinist

A Practical Journal of Machine Construction

Issued Weekly by the Hill Publishing Company : : : 505 Pearl Street, New York

Price 15 Cents, $4.00 per Year Contents 417. Advertising Index 69

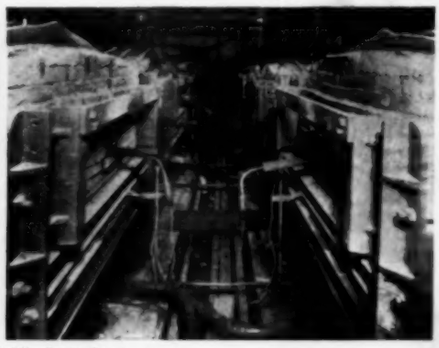
HOSKINS

## "Hardening-Room Efficiency"—is raised to a high point by use of Hoskins Pyrometers

— Simple devices that tell *exact* temperatures. Through bringing this definite knowledge, they make *certainty* possible in heat-treatment work.

Their use *raises* hardening-room efficiency! First, by vastly increasing *first-quality* results. Second, by eliminating "spoiled products". Third, by enabling the production from the same amount of material and labor as you now employ — of a *higher-valued* output. Here's a case —

***Heat-treating Furnaces*** ***Temperature Meters*** ***The Thermo-Couples***



*Photographed in the E. M. F. Automobile Co.'s "Plant 3", Detroit.*

— to which after being carefully and expensively worked, the parts come for heat-treatment. If the chamber temperature is right, this operation is successful, if it is not right there is often a large but *preventable* loss.

— by turning the switches below, these meters show instantly and definitely the chamber temperature of any furnace. This knowledge is protection against loss—is an efficiency builder.

— installed at the rear of the furnaces, these "thermo-couples" *sense* the chamber temperature and carry this by a small electric current, which they generate,—to the meter. (The connecting leads are placed in a protecting conduit).

**In this Automobile Plant** — in this hardening room, where thousands of dollars of steel is heat-treated daily, where the nature of the finished product requires the highest perfection in its parts — and where the volume of it demands a low individual manufacturing cost — *here*, definitely known temperatures are daily practice. The value of exact methods is realized on! These are capitalized, made efficiency-factors, and *pay profits*.

**Right in Your Own Shop** — you can raise remarkably the efficiency of your work with our Pyrometers. They will help you to turn out a better product, *and to be sure of it.* Our complete portable instrument for $50.00, would itself prove a decided cost-reducer for you. And if you have a number of furnaces, lead-pots or baths — an installation of Hoskins Pyrometers would bring you a *large* cost saving.

*Write today for our "Bulletin 3" and free copy of "How to Determine the Right Hardening Temperature".*

## HOSKINS MANUFACTURING COMPANY

*Electric—Furnaces, Pyrometers and Heating Appliances* 451 Lawton Avenue, DETROIT.

231

# Bement Hammers

## Rated by the Weight of the Falling Parts, Exclusive of Steam Pressure, which add enormously to the blow

2000-lb. Bement Steam Drop Hammer with Foot-treadle Control.

BEMENT STEAM DROP HAMMERS are double acting—take steam above and below piston—and can be run automatically.

They are rigidly and massively constructed to withstand the constant shock and jar of heavy forge work, and to maintain true alignment of cylinder, frames, ram and anvil.

Special construction prevents shocks and jars from being transmitted to cylinder casting. Tie rods and tie bolts are steel forgings.

Heavy springs are placed at the necessary points to secure the proper elasticity.

Frames are pocketed in anvil to prevent spreading and lipped over anvil to prevent lateral movement.

Regularly equipped with foot treadle but can be equipped also with hand lever without additional charge.

Built in 11 sizes for steam or compressed air.

*Write for the book "Bement Hammers," it is a valuable treatise on erecting and maintaining.*

# Niles-Bement-Pond Company

**111 Broadway, New York. 23-25 Victoria St., London, S. W.**

**SALES OFFICES—Boston:** Oliver Bldg. **Philadelphia:** 21st and Callowhill Sts. **Pittsburgh:** Frick Bldg. **Cleveland:** Rockefeller Bldg. **Hamilton, O.:** The Niles Tool Works Co. **Detroit:** Majestic Bldg. **Chicago:** Commercial National Bank Bldg. **St. Louis:** 516 No. Third St. **Birmingham, Ala.:** Brown-Marx Bldg. **Agents for California, Nevada and Arizona:** Harron, Rickard & McCone, San Francisco and Los Angeles. **Washington and Idaho:** Hallidie Machinery Co., Seattle and Spokane. **Oregon:** Portland Machinery Co., Portland. **Agents for Canada:** The Canadian Fairbanks Co., Ltd., Montreal, Toronto and Vancouver. **Japan:** F. W. Horne, 70-C Yokohama. **Italy:** Ing. Ercole Vaghi, Milan. **Germany:** F. G. Kretschmer & Co., Frankfort a.M.

(*See pages* 61, 62, 63 and 64)

# Early Days of an Important Industry*

## Editorial Correspondence

*Evidence tending to show that cold-punched nuts were first made in the United States at Pawtucket, R. I. Extracts from old machine-shop records show shop and business conditions of many years ago.*

*Copyright 1911, by Rhode Island Tool Company.

Let us suppose that on some fine evening, 75 years ago, the doors of a certain machine shop were carefully locked after the men went home to supper; let us suppose still further that they had never been unlocked from that day until this, that there had been no deterioriation from age and that they were now to be opened. Would you not make an effort to visit that shop to see the machines of the old days, to note the small tools that were then used, to smile at the crudities of the early methods and perhaps to think that we now do things far better? (Whether we do or not, considering our accumulated knowledge and improved facilities, is quite another matter).

While I cannot open for you a machine-shop door that has been closed for 75 years, I can show and quote from machine-shop records that are nearly that number of years old, records that trace the founding of an important industry and throw interesting sidelights upon shop doings of those days.

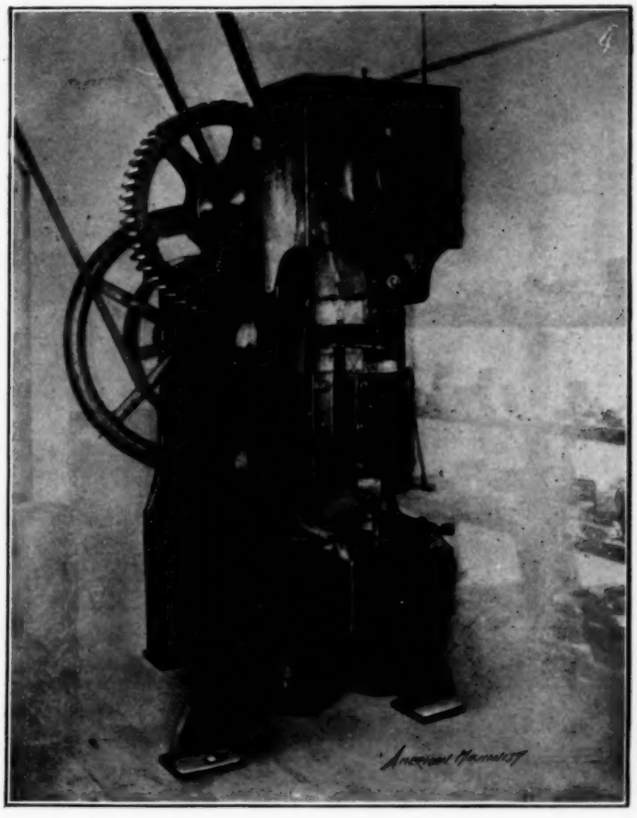
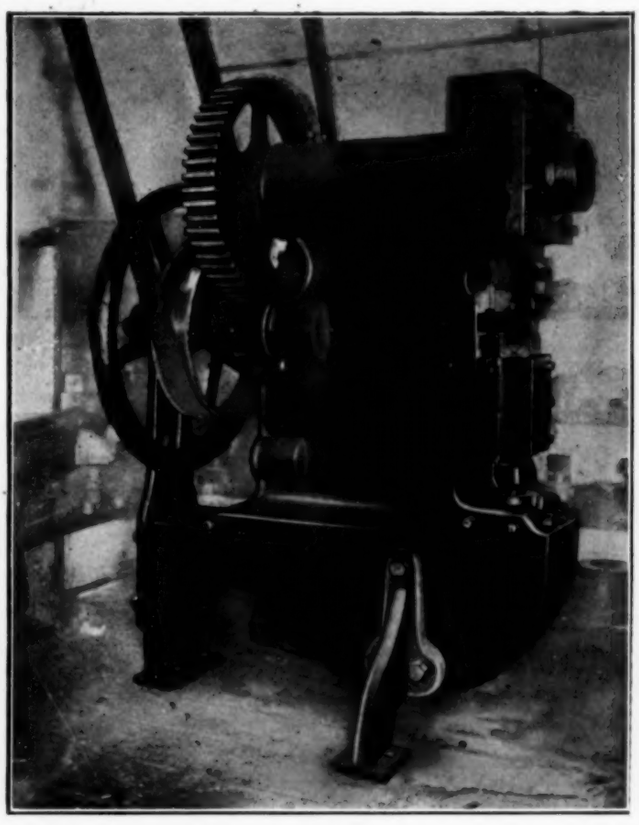


FIG. 1.



THE FIELD PRESS FIG. 2.

### THE BEGINNING OF MAKING COLD-PUNCHED NUTS

The first cold-punched nuts made in the United States are believed to have been made in Pawtucket, Rhode Island. In 1834 Jeremiah O. and Joseph Arnold started a plant for punching iron nuts cold in a small shop on the Moshassuck river. Somewhat later Joseph Arnold retired from the business and William Field joined with Jeremiah Arnold in carrying on the business under the name of William Field & Co.

In February, 1846, they moved the business to Providence, and in April of the following year changed the name of the firm to the Providence Tool Company. In June of that year, 1847, they incorporated.

In 1856 this firm consolidated with the Providence Forge and Nut Company, a firm which had been started in 1852.

In 1883 the Providence Tool Company was in financial difficulty, and the Rhode Island Tool Company was formed to take over its bolt and nut business, and in so doing acquired what was known as the West River Street plant in Providence. This is the plant at present owned and used by the Rhode Island Tool Company, the direct, lineal descendant of the founder company. Through the courtesy of the president, William C. Dart, I have had access to a large mass of old records going back into the early 1840's, all in a splendid state of preservation and showing with interesting detail, on the one hand some of the difficulties, and on the other the successes in the early days of making bolts and nuts, plane irons, etc.

Jeremiah Arnold seems to have been the skilled machinist of the firm. From a history of Pawtucket published on the 250th anniversary of the town in 1876 I quote the following statement made by Mr. Arnold when over 80 years of age: "In 1846 I took charge of a shop called the Providence Tool Comapny. They ran seven presses for making bolts and washers (the first press I built for this kind of

work was in 1833). I started ten presses for the Providence Forge and Nut Company—one a very large press. I punched nuts four inches in diameter, two inches thick, from cold iron."

Mr. Field seems to have been the vigorous business man of the firm. An extract from a letter of Lawton I. Ware, written on February 28, 1848, gives us a hint as to his personal appearance. "One of the firm of Pruqu & Vosburge, thinks Mr. Field to be a dashing young fellow. He says he was in their store last summer, dressed in white throughout—and he afterward saw him with his lady twice, on the Troy road, riding out in great style. He was a most magnificently dressed young man, and showed off first rate."

In business matters we are led to believe that he was somewhat exacting, for there are two letters, one written by Mr. Ware and the other by Mr. Ware's predecessor, Mr. Harris, each tendering a resignation from the position of traveling salesman. In Mr. Ware's letter he refers to "the blowing up that Mr. Field gave me."

### Two of the Early Punch Presses

It speaks well for the designing ability of these men, Field and Arnold, when we consider that two presses made by them prior to the year 1846 are still set up in the factory of the Rhode Island Tool Company, and are used for occasional jobs. Figs. 1 and 2 show what is known as the Field press, a press which is believed to have been in use prior to the year 1845, for in that year a larger press, shown in Figs. 3 and 4, was built and put into operation by Jeremiah Arnold. The following extracts from letters refer to the building of this press and give us a little idea of how long it took to get it into operation.

"June 9, 1845.

"T. & H. Garrett:

"We now make nuts 2x¾, and shall soon be able to make much larger, as we are putting a much heavier press in operation."

"June 27, 1845.

"Nathaniel Messer, Pittsfield, Mass.:

"We make nuts 2x¾ and will be prepared within a month to make them 3x1½ inches."

"Sept. 17, 1845.

"Burbank & Chase:

"We now make nuts up to 3x1½ inches, which is larger than any nuts that have ever before been punched."

In passing it must be said that all of the old letters of this firm, going back before the days of the general use of the copying press, are most carefully copied by long hand into record books. A mere glance at these books is sufficient to make anyone wish that the art of writing was not now extinct.

This too was before the day of envelops and postage stamps. The letters received, and now on file, were written on one side of the sheet, then folded into envelop form and sealed by a wax wafer. Postage was charged by the post office and a monthly bill rendered. See Fig. 5, an illustration of a bill of August 1, 1848, to Field and Company.

### Early Difficulties in Making Nuts

The nuts of that day were a far different product from those that we now know, as will be believed by a glance at Fig. 6 which shows a string of three nut blanks, each soldered on the back to a piece of strap iron, and apparently forming a traveling salesman's sample. It is not known how old these nuts are, as they were rescued from an obscure corner of the Providence plant.

In those early days it was difficult to get stock of suitable size, there was no uniformity either in outside dimensions, thickness, or diameter of hole, for nuts for given diameter of bolts. In reading the old letters we get a dim idea of the difficulties of manufacturing when there were no standards to manufacture to, and when drawings were but little used as a means of conveying information.

Two qualities of nuts were made; one, the ordinary and cheaper kind, was passed through the dies but once; another, more expensive kind considered as a nut suitable for the best of machinery was put through the dies three or four times. The holes were always punched a trifle large and the nuts were closed in upon a mandrel to size them.

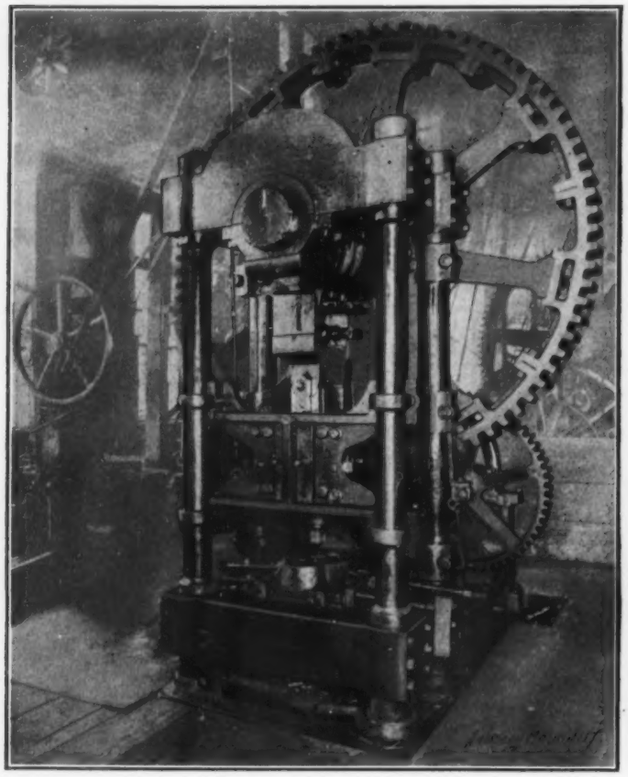


Fig. 3.

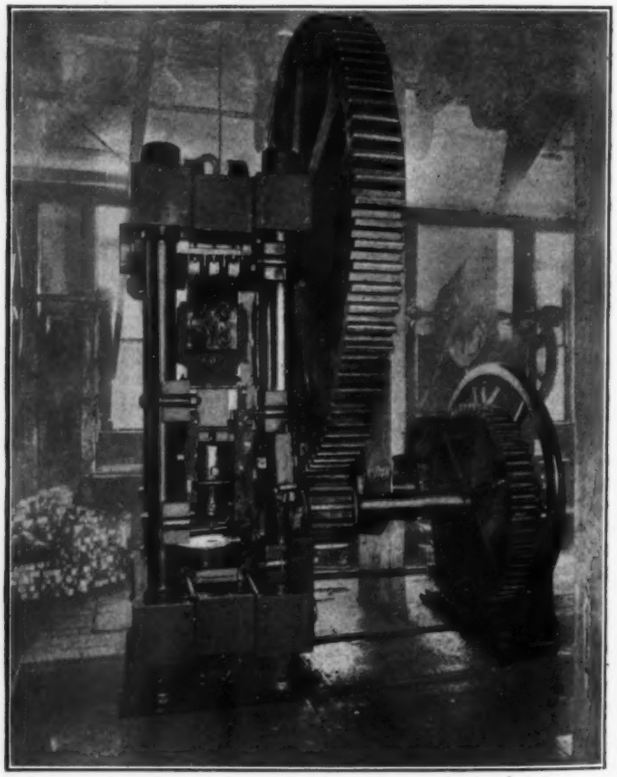


Fig. 4.

The Arnold Press

Nuts thicker than 1½ inches were made by welding together two thin nuts. We may readily believe that this method was none too satisfactory, for there are letters from customers kicking because they were ragged and rough and the holes in the two welded parts did not line up.

Yet in spite of all these things a thriving business was done, for the objections of practically all customers were met by the response, "They are good, strong nuts." In those days strength was important.

A few extracts on these manufacturing conditions are worth while:

"Philadelphia, June 14, 1847.

"Mr. Wm. Field, Agt., Providence, R. I.

"Today I saw the foreman of I. P. Morris & Co. at their works, who informed me that they had not given our nuts a trial yet, but would do so soon. His opinion is, that it is more labor to finish up our nuts than to finish those that are forged, on account of the ragged sides which our nuts have. He says that ours will require as much again filing as the forged ones do.

POST-OFFICE BILL.

BOX NO. 97 Postage from 1st to 31st of July $1.57

Payable this 1st day of August, 1848.

N. B.—Prompt payment is very desirable, as a clerk is specially designated to receive the same, from 9 to 12 A. M., and 1 to 3 P. M.

FIG. 5. POST-OFFICE BILL FOR LETTER POSTAGE—AUGUST, 1848

Very respectfully yours,
"CHARLES F. HARRIS."

"May 19, 1845.

"T. & H. Garrett,

"Gents: Above please find invoice and bill of lading; merchant vessel to sail to-

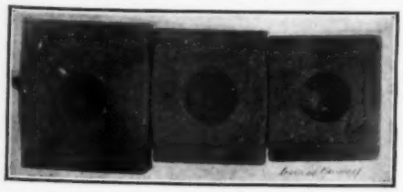


FIG. 6. THREE OLD NUT BLANKS

day. The 15/16x1 7/16 nuts we were obliged to make from the inch iron, none of the proper size to be found in the market, and in punching the corners of some of the nuts tore out, which gives them a rough appearance, but you will find them good, strong nuts. There are not so many of them as ordered, but we used up all the iron of that size we could find."

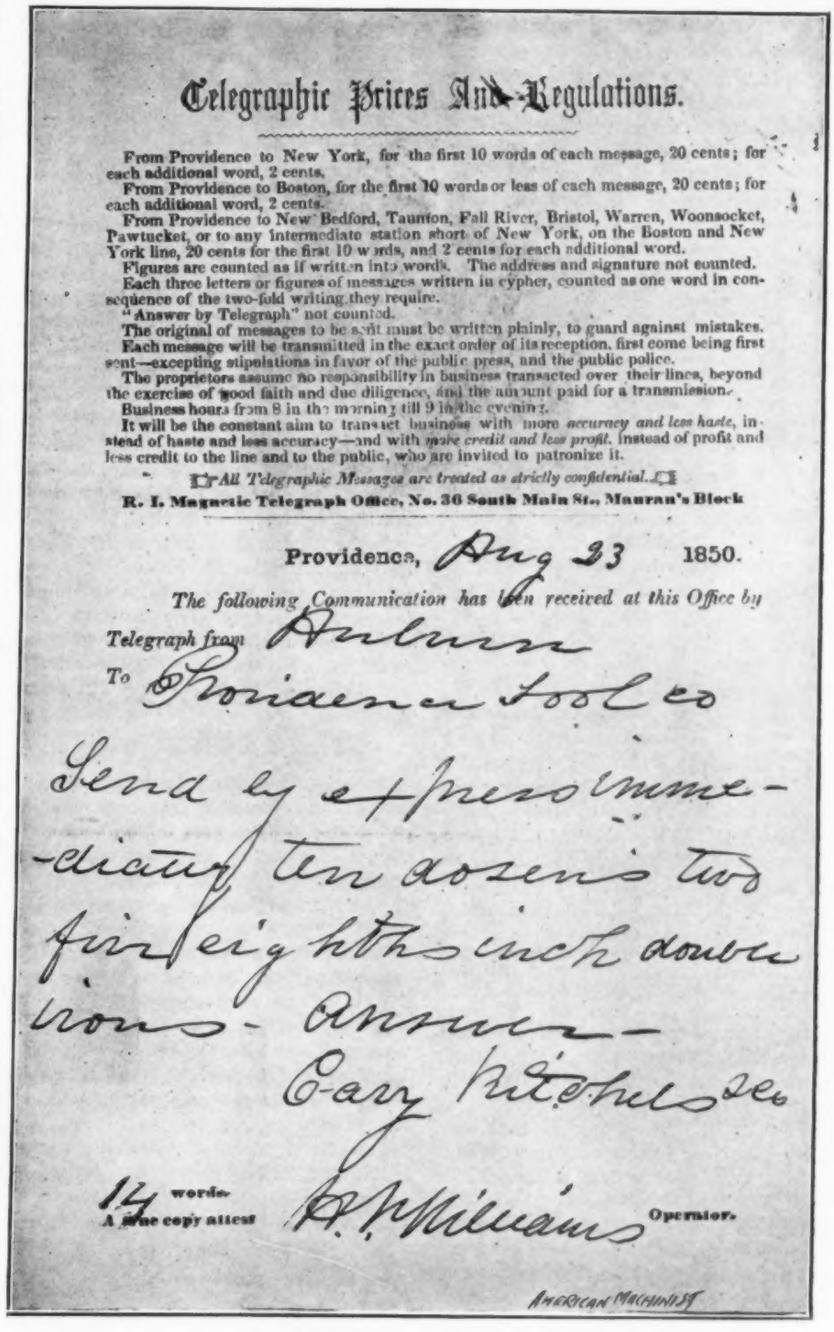
"New York, May 28, 1847.

"Mr. Wm. Field, Agt., Providence, R. I.

"If the whole size of the nut given alone is not in proportion to the size of the hole, please alter it to make it so. I find when they speak of the size of nuts here they speak of the size of the bolts which they are to use with them. Mr. Brown says the hole in these nuts should be a little scant of the size of the iron.

"Very respectfully yours,
"CHARLES F. HARRIS."

In addition to these manufacturing troubles, there were troubles of a business nature. There seems to have been a settled objection against American goods, particularly in the markets around New York City and Philadelphia. English manufacturers were given the preference, and one of the stumbling blocks in the pathway of the traveling salesman was the belief on the part of prospective customers that his firm could not produce articles equal in quality to those imported from England.


Telegraphic Prices And Regulations.

From Providence to New York, for the first 10 words of each message, 20 cents; for each additional word, 2 cents.

From Providence to Boston, for the first 10 words or less of each message, 20 cents; for each additional word, 2 cents.

From Providence to New Bedford, Taunton, Fall River, Bristol, Warren, Woonsocket, Pawtucket, or to any intermediate station short of New York, on the Boston and New York line, 20 cents for the first 10 words, and 2 cents for each additional word.

Figures are counted as if written into words. The address and signature not counted.

Each three letters or figures of messages written in cypher, counted as one word in consequence of the two-fold writing they require.

"Answer by Telegraph" not counted.

The original of messages to be sent must be written plainly, to guard against mistakes.

Each message will be transmitted in the exact order of its reception, first come being first sent—excepting stipulations in favor of the public press, and the public police.

The proprietors assume no responsibility in business transacted over their lines, beyond the exercise of good faith and due diligence, and the amount paid for a transmission.

Business hours from 8 in the morning till 9 in the evening.

It will be the constant aim to transact business with more *accuracy and less haste*, instead of haste and less accuracy—and with *more credit and less profit*. Instead of profit and less credit to the line and to the public, who are invited to patronize it.

*All Telegraphic Messages are treated as strictly confidential.*

R. I. Magnetic Telegraph Office, No. 36 South Main St., Mauran's Block

Providence, Aug 23 1850.

*The following Communication has been received at this Office by*

*Telegraph from* Auburn

*To* Providence Tool Co

Send by express immediately ten dozen six sixteenths inch double irons. Answer.

Cary Mitchell & Co

14 words. A true copy attest H. P. Williams Operator.

AMERICAN MACHINIST

FIG. 7. A TELEGRAPHIC ORDER OF 1850

Let me quote from two letters on this phase of business conditions:

"New York, May 15, 1847.

"Mr. Wm. Field, Agt., Providence, R. I.

"I inclose you a small order from Messrs. Dennison & Disbrow, of this

place. These gentlemen are in immediate want of the goods, and as most of the merchants complain of the delay that there is attending delivery of most American goods, it behooves us to use all dispatch possible."

"June 11, 1847.

"Mr. Wm. Field, Agt., Providence, R. I.

"Dear Sir: I have entered upon my duties here and thus far find the same difficulties to encounter that I had in New York, and those things to be overcome here to be handled slowly and judiciously. Being Germans, if they get a notion into their heads, it is impossible to con-

Providence Tool Co. To L. S. Ware. Dr.

| | | | |
|---|---|---|---|
| 1848. | Feb. 1 | Stage fare to Sturbridge (Fiskdale) | $2.00 |
| | Feb. 1 | Dinner and supper | 0.56 |
| | Feb. 2 | Lodging and breakfast at Fiskdale | 0.31 |
| | Feb. 2 | Fare from Fiskdale to depot (Brookfield) | 1.00 |
| | Feb. 2 | Horse hire to Jos. Coles | 1.00 |
| | | Fare from Brookfield to Springfield | 0.95 |
| | | Supper at Warren (between Brookfield and Springfield) | 0.25 |
| | Feb. 3 | Paid board at Springfield | 1.25 |
| | | Railroad fare to Worcester, $1.65; hack, $0.25 | 1.90 |
| | Feb. 4 | Paid board at Worcester | 2.00 |
| | | Fare to Norwich, $1.50; board at Norwich, $0.75 | 2.25 |
| | Feb. 5 | Fare and dinner at Greenwich | 0.19 |
| | | Fare to Worcester, $1.50; supper and lodging Worcester, $1.00 | 2.50 |
| | Feb. 6 | Fare from Worcester to Boston | 1.25 |
| | Feb. 7 | Supper, lodging and breakfast at U. S. Hotel, $2.00; dinner, 0.25 | 2.25 |
| | | Supper $0.25, 18th; dinner, $0.50; railroad to Providence, $1.25 | 2.00 |
| | Feb. 8 | Hack at Providence | 0.25 |
| | | | $21.91 |

ANOTHER EXPENSE MEMORANDUM.

vince them that anything else is right. For example, they say the most of these Germans order Butcher irons with particular instructions that if they cannot send them with the brand not to send any. They have been imposed upon, I am told, in this particular article some four or five years ago, and since that time the very name of American plane irons is enough to condemn them. I don't know but prejudice goes further in some cases here than it did in New York."

### From the Credit Books

These days were before the general use of commercial agencies, and among the old records are two credit books, giving an idea of the financial standing of the firm's customers. Many familiar names appear here, most of them with good ratings.

E. & T. Fairbanks & Co., St. Johnsbury, Vt.

Josh. F. Fairbanks the Co. rep. in /51 worth 150 or 200 MS May /53 A. No. 1 May /53. Always good.

J. Morton Poole & Co., Wilmington, Del.

March /54 P. a first-rate business man, well off & in fact rich, honest & industrious & good for all he wants. March 13/55 Good as the Bank do a large business—are responsible & Prompt.

Wood Light & Co., Worcester, Mass.

May /54. Late Light Woodburn & Co., are smart, energetic men & have made some money & lost some, but still in fair Cr. should give a reasonable Cr.

### Prices of Materials

On the subject of prices of materials I find a letter dated January 30, 1850, in which it is stated that William Jessop & Sons will pay two cents per pound for steel scrap, provided payment is taken in cast steel of the warranted quality at 15 cents per pound.

Another letter, written from Albany, on February 28, 1848, says that the Hudson & Berkshire Railroad Company has just taken up 14 miles of railroad rails, these rails being made of iron 2¼ to 2⅝ inches wide and 9/16 inch thick. These rails were of English manufacture and were offered for sale at a price of $40 per ton, and although some sections had many ragged places where the corners had been worn away by the car wheels, yet the writer believes they will make good nuts.

### Hours of Labor and Wages

Occasionally someone comments upon the fact that hours of labor are steadily shortening as time goes on, without conveying any idea of just what that shortening means. In the machine shop of 1840 a man worked on the average of 11 hours per day, as it is phrased "longer in summer and less in winter." The rates of pay ran from $1 to $2 per day, the higher rate being commanded by only a few of the best men. Thus the day's rate of Jeremiah O. Arnold, whom we have referred to several times above, is given in the old pay-roll book as equal to $2 per day.

I insert portions of two letters written to men whom the company desired to hire, one as a toolmaker, and the other as a foreman.

"Providence, Feby. 28, 1846.

"Mr. Richard A. Brown:

"We have now a good situation for you provided you come in a short time, say, by or before the first of April. We want a man to take charge of our press room, keep tools in order, etc., and believe you would be just the man if you will come and can be here in season. Our works are removed to this place and very pleasantly situated at the lower end of South Main St. We would be willing to engage with you for one year from April 1st and give the same wages you now have, that is 10/ per day, although it is much higher than we have been paying."

"April 6, 1846.

"Mr. Daniel Horton:

"I could give you good employment in this City where I am now located for one year at $1.75 per day. The work would consist of various kinds, but principally in making tools and would be of that variety which I have no doubt would be satisfactory—our hours of labour will average for the

Providence Tool Co. To Chas. F. Harris. Dr.

| | | | |
|---|---|---|---|
| 1847. | | | |
| Oct. | 14 | Fare to Boston, $1.25; hack each end, $0.50 | $1.75 |
| | 16 | Board, $4.75; hack, $0.25 | 5.00 |
| | 16 | Fare to Providence, $1.25; 18th, fare to Boston, $1.25 | 2.50 |
| | 18 | Hack each end, $0.50; 21st, bill board, $5.50 | 6.00 |
| | 21 | Passage to Providence, $1.25; hack, $0.25 | 1.50 |
| | 27 | Passage to Worcester, $1.25; hack, $0.25 | 1.50 |
| | 27 | Paid Ross $1 for leaving one of our show cards at each place on this road | 1.00 |
| | 28 | Board at Worcester, $1.75; porter, $0.25 | 2.00 |
| | 28 | Passage to Springfield | 1.65 |
| | 29 | Board at Springfield | 2.00 |
| | 29 | Porter and hack | 0.50 |
| | 29 | Passage to Albany | 2.75 |
| | 29 | Porter for baggage | 0.25 |
| | 30 | Passage to Troy and back | 0.40 |
| | 30 | Passage to New York | 2.00 |
| | 30 | Delavan house bill | 2.50 |
| | 30 | Porter, $0.25; supper on steamboat, $0.50 | 0.75 |
| | 31 | Porter, $0.25; baggage to hotel, $0.25 | 0.50 |
| Nov. | 1 | Passage to Patterson, $1.00; ferry, $0.12; dinner, $0.50 | 1.62 |
| | 2 | Postage, 5c.; 3d, 5c.; express, 38c.; Brooklyn, 4c | 0.52 |
| | 2 | Jersey City, 12c.; 11th, omnibus, 12c.; 12th, Brooklyn, 12c | 0.36 |
| | 15 | Astor House, bill, $36.75; porter, $0.50 | 37.25 |
| | 15 | Fare to Philadelphia, $4; extra on baggage, $0.50 | 4.50 |
| | 15 | Porter, $0.25; 17th, Jones bill, bill, $6.00 | 6.25 |
| | 17 | Fare to New York, $4; extra on baggage, $0.50 | 4.50 |
| | 18 | Board, $2.00; hack and porter, $0.50 | 2.50 |
| | 18 | Fare to Providence, $3.00; 19th, hack, $0.25 | 3.25 |
| | | | $95.30 |

EXPENSE MEMORANDUM OF A TRAVELING SALESMAN IN 1847.

year 11 hours a day, longer in summer and less in winter. Should you not conclude to work for me I shall be happy to see you here again, and the probability is that you can do as well here is in Philada."

That shorter hours were wanted of labor even in those early days is written to A. Fullerton & Co. on September 23, 1847. "We cannot answer at present, as our press men have all made a strike for the ten-hour system and the presses are all still.."

I also present a portion of the pay-roll record for the month of February, 1846.

February, 1846.

| Names. | Days. | Price, s. | d. | Amount. |
|---|---|---|---|---|
| J. O. Arnold | 25½ | 12 | | $51.50 |
| Edwin Howland | 21½ | 12 | | 43.00 |
| William Murray | 21 | 6 | | 21.00 |
| William Chapman | 18 | 6 | | 18.00 |
| Elijah Baker | 23 | 9 | | 34.50 |
| William McNutt | 24 | 5 | 6 | 22.00 |
| John McIlvain | 17½ | 6 | 6 | 18.91 |
| Joseph Wheaton | 22 | 7 | 6 | 27.50 |
| William Ketch | 21½ | 7 | | 25.08 |

A striking thing is that the rates are expressed in shillings, or shilling and pence, while the totals are expressed in dollars and cents. Again, this shilling is not the English shilling, but is the depreciated New England shilling, of the value of 16½ cents, or six shillings to the dollar. It did not exist as a coin at all. What a striking example of the vitality of old standards! Our decimal United States currency had been in use for over 50 years before this pay-roll account was made up; yet here we find the rate expressed in terms of a former currency that had gone out of use, and for which there was no coinage in existence.

That shop conditions were not always harmonious even in those early days is shown by this brief extract from a letter written by A. Fullerton & Co. on September 23, 1847. "We cannot answer at present, as our press men have all made a strike for the ten-hour system and the presses are all still."

### Traveling Expenses in 1847 and 1848

From numerous expense memoranda of the traveling salesmen, I have selected two. The increased cost of living is the popular subject just now, and if one will take the trouble to study some of the items in these accounts, he will find that while the cost of food and lodging is higher than it was when Messrs. Harris and Ware were selling nuts, 60 and more years ago, the cost of transportation is considerably less. A breakfast and lodging for 31 cents seems inexpensive to us, but one can go by railroad from Worcester to Boston for $1 today, where Mr. Ware had to pay $1.25.

### A Telegram of 1850

Fig. 7 is a reproduction of a telegraphic order dated August 23, 1850. It is well worth anyone's time to read the prices and regulations for telegrams, particularly if they are disposed to believe that things are not as good as they used to be. When reading this over just remember that the telegraph rate from Providence to New York today is 30 cents for the first 10 words.

### A Thanksgiving Turkey of 1848

As a fitting close to these items of history and reminiscence, I present entire, without any change in spelling or punctuation, a letter written by "A Shop Hand" after his Thanksgiving dinner on November 30, 1848. The writer little thought that 62 years later his letter would be printed in the columns of a technical journal. Although his name is unknown to us, he must have been a man of parts, perhaps a political leader, for it is evident that he had a complete knowledge of the then recent war with Mexico, and that he was a stanch supporter of General Taylor, who had just been elected to the presidency of the United States—but the letter tells its own story.

"To The Gentlemen Of Prov. Tool Co.

"Your allmost unpresidented liberality of yesterday towards the men in your employ should & I doubt not does call forth the gratitude of all our hearts but as I had the misfortune not to hear the sentiment if any there was given (which called forth the hearty cheers of all present) I am ignorant of its direction neither do I know whether the present was made in honour of and in gratitude for the late political triumph of the undaunted brave and successful victor of Palo, Alto, Resaca De La Palma, Monterey, Buena Vista, & last & not least of all Nov. 7, 48 or the religious promtings of benevolent hearts with a desire to do good and verify the scripture enjunction to remember the poor or he that giveth to the poor lendeth to the Lord but be that as it may it was a generous and benevolent act & one that should call forth something more from us the humble recipients than merely putting forth the hand to receive what is so kindly and gratuitously given. But so far as I am concerned I tender to you all my sincere and heart felt thanks in consideration of the valuable present I have received through your kindness.

"It is an old addage & a true one that the proof of a pudding is in the eating. I have tested your turkey by this never failing rule and do assure you it made a super-excellent dinner. Here after dinner permit me to offer a sentiment. May the Prov. Tool Co. be as successfull in their present honest & honourable business in winning the laurels of honour & extreme wealth as has been Genl. Taylors from his debut at Palo Alto untill he has reached to within view of the white house at Washington which will surrender to his command on the fourth of March 49 & may Genl. Taylor be as successfull in administering the government of the Nation for the next four years as he has been in that of the army & may the Nation so prosper & business so revive & flourish that the employers according to the well known proverb of 1840 can amply afford to give to their common laborers $2 per day & roast beef (or turkey, which would be full equal)

"Prov. Nov. 30, 48, after dinner.

"Yours Respectfully,

"A Shop Hand.

"P. S. please excuse all errors in form and composition."

L. P. A.

## Unfitness

By Con Wise

Physicians have discovered that laziness is a disease, or rather that it is a symptom or a result of many diseases. They say that a normal man has an inclination to work all that is good for him, and that any man who does not work when work is offered is sick.

On the other hand educators say that while the normal man is quite willing and able to work, he cannot do himself justice unless he is given a kind of work that is attractive to him, because of his natural fitness for it.

For example, if John, out on the grinder, appears lazy it may be because he is sick, or because he was intended by nature to run a hand organ instead. In either case he is to be pitied. So also is his employer, for the man needs his daily wage and the employer equally needs his daily output. The employer is better off than the workman because he can hire a dozen men equally sick or equally unfitted at any time.

The employer needs some way in which he can discover who are sick, who are unfitted, so that he may know who are worth training and who need a course at a hospital.

It seems impossible to expect men to have sufficient curiosity about their health to consult competent medical men so long as they can stand up and carry home a pay envelop. It does seem as if it would pay employers to turn suspected cases over to a physician and pay the bill themselves for the sake of saving to themselves the increased value of the services of a well man over those of a sick man.

The other case, that of vocational direction, is a very delicate one. It is a serious matter to advise a man that he would make a better organ grinder than a planer hand, because it may affect his entire life and because the evidence is so very circumstantial. Then, too, the man himself may be entirely incompetent to decide for what he is best fitted. He is too near to the subject so to speak. He lacks perspective and experience in other lines of work.

For decisions in this case we must wait with patience the fruition of the movement now spreading over the country for study of vocational direction.

## Laying Out Angles

A method of laying out angles without a protractor, and one quite accurate enough for most drawing-board work, is to strike a radius of 57.3 to any convenient scale, and then lay off along the arc as many units of the same scale as the degrees of angle required. If the spacing on the arc is done by stepping off with dividers, there will be a slight error due to the difference between the lengths of the arc and the chord; but if the step is 10 degrees, the error is only 1/100 of a degree; with a single step of 20 degrees, the error is about 1/10 of a degree; a step of 30 degrees gives an error of about 3/10 of a degree. Larger angles may be laid off by adding small angles, combining with the standard triangles.

# Method of Making Accurate Angles

By C. L. Goodrich*

It is often necessary for the toolmaker to grind or plane accurate angles. Sometimes the bevel protractor will answer, but occasionally on refined work a superior method is required. In some cases in order to take an angular milling cut, or to bore a drill jig or other fixture, it is found desirable first to make an angle plate.

Fig. 1 illustrates a master plate which, with the aid of two plugs of the correct dimensions, as shown, makes it a very simple operation to grind the 16-degree angle plate illustrated. Fig. 2 shows the master plate with plugs inserted and also represents the exact method of clamping and grinding the angle plate. The formula is etched upon the plate and is suitable when the distance from center to center of holes is three inches.

The mathematics of the scheme and a line drawing recently appeared in the American Machinist, but the photographic reproductions herewith will possibly convey a clearer idea of the method.

The centers of the two holes in the master plate are the same distance from the edge of the plate. The angle plate that is to be ground is clamped so that its lower edge is in contact with the two plugs as shown. The calculation for the diameters of the part of the plugs coming in contact with the plate, is as follows:

| | |
|---|---|
| Angle to be ground is | 16 degrees. |
| Sine of 16 degrees is | 0.27564 |
| Six times sine = | 1.65384 |
| Diameter of small plug assume as | 0.250 |
| Diameter of large plug = | 1.90384 |

In making the plugs care should be taken to obtain concentricity between the pilot fitting the hole in the master plate and the body or portion of the plug against which the plate that is being ground rests. Care in clamping the plate to the master must be observed to insure against any movement away from the plugs.

*Department foreman, Pratt & Whitney Company.

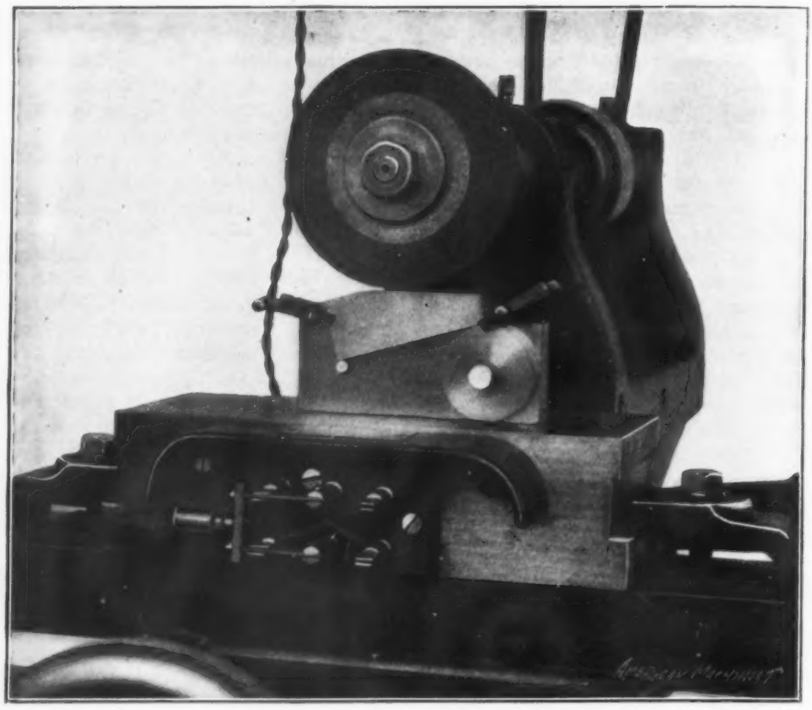


Fig. 2. Method of Making Accurate Angles

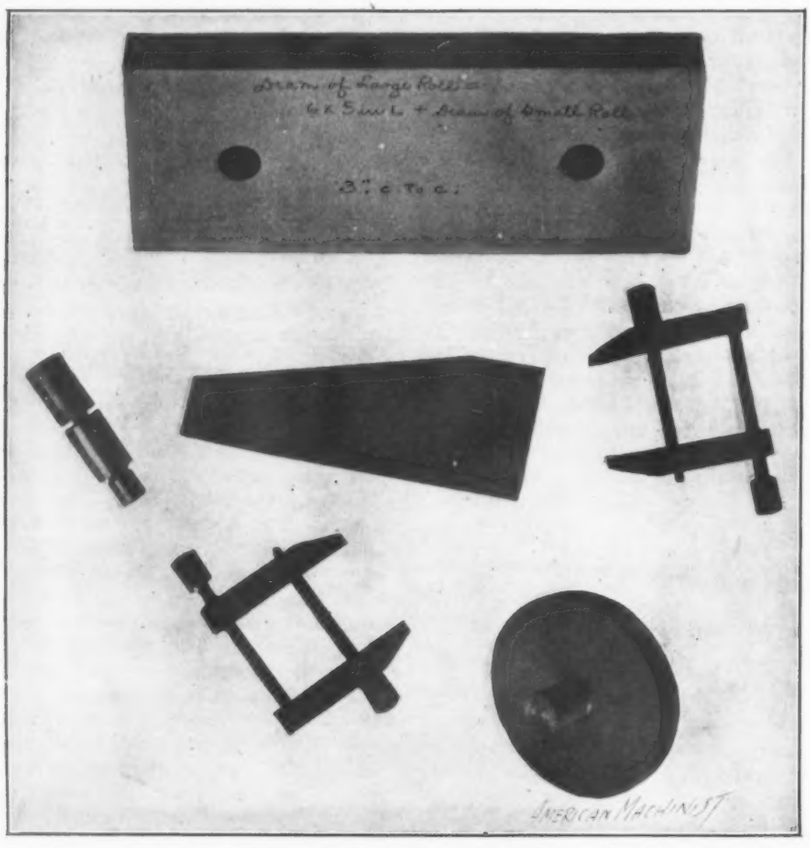



Fig. 1. Method of Making Accurate Angles

It is probably not generally appreciated that the greatest invention of Isaac Babbitt was not the anti-friction metal that bears his name, but the accompanying process of using such a metal for the bearings of machines or "babbitting." This process has had the widest influence on the development of high-speed machinery. Isaac Babbitt was an American, born in Taunton, Mass., July 26, 1799, died May 26, 1862. As a boy he learned the goldsmiths' trade. In 1824 he founded the manufacture of britannia ware in the United States. In 1839 he discovered "babbitt" metal for which Congress, at a later date, granted him a pension of $20,000. The proportion of babbitted bearings used today compared with all other forms, is something we cannot know, but it must be so great as to make the number of the others comparatively insignificant.

# Building Industrial Enterprises

Special Correspondence

*Abstract of a paper before the Technology Club of Syracuse, by John E. Sweet, showing the six events that enter into the building up of any successful industrial enterprise.*

Nothing has ever been made, except a noise or trouble, without work; and some of us work pretty hard sometimes in making both. No material thing has been made without work, some with a little work and a good deal of something else, and some with a lot of work and various other things. A puddler does a lot of work with little intelligence; Dickens killed himself with work, using the simplest of tools.

Nothing but ideas are created with intelligence alone, and no material thing can be made by labor. It is often said that labor creates everything—labor, alone, creates nothing. I have tried to think out something that labor could create, and could get no farther than an Indian gathering grass and making it into a basket, and when I got through, found that there were three things that enter into the construction of the basket: material, labor and intelligent direction; and the intelligent direction was quite as essential as the grass and the labor.

### Making Baskets

While the three things, material, labor and intelligent direction (skill or artistic instinct), are equally important, they are not necessarily equally valuable. The earth would grow grass enough for billions of baskets, and so it is cheap. Millions of white men could be found to collect the grass, but those who could weaves the basket are few, and, if baskets were a necessity and wanted in quantities, the basket weavers could demand and would receive a fabulous reward. This illustrates the whole subject of why some men receive more pay than others. It is the question of supply and demand.

With a pair of scissors the Indian could make five baskets as readily as four without, and this introduces the fourth element—tools, and in most material structures the fourth element is as essential as the others; that is, it takes material and tools, labor and intelligence. I would like to carry this basket idea through as an illustration of about what takes place in real life. The Indian cuts, gathers and prepares the grass and makes a basket a day and sells it for a dollar, consuming some time in the selling, even though customers come and buy. Another Indian can cut and gather the grass, but cannot make a basket; so he is worth only a half a dollar a day. A boy with a pair of scissors can prepare enough for four baskets and, if the Indian is relieved of the selling, he can make four baskets a day, but cannot sell them.

A young Carnegie grasps the situation, enters into an arrangement, hires the grass cutter and boy, agrees to sell the product and share the profits. There is, after paying for the help, $3 to divide, the Indian getting a dollar and a half, instead of a dollar, as before.

### The Four Elements

At times the labor and intelligence are centered in the one man, and again, there may be all four centered in the one man; but they are there and no matter what the man's ability may be, whatever he aims to do, he has to learn the trade; h has to learn to use the tools.

About as simple an operation as there is is driving a nail or shoving a jack plane. Who ever drove a nail at first time trying? Few! And who, that has never tried, can shove a jack plane and make it take a shaving? Fewer still! One who has never tried, may draw a bow over a violin, and the chances are a hundred to one he will make a squeak; with a few trials he will make a noise; while the violinist, with the same instrument and same bow, will make a musical note. One may be an accomplished penman and a good grammarian without being able to write any sort of a letter, much less an accepted article. In the learned professions—doctors, lawyers and ministers—they all try it on the dog first, start in in the villages or rural districts; the dramatic authors try out their first nights in Syracuse, and the manufacturers usually prefer the mechanical engineer after he has worked two or three years for someone else.

Let us consider the four elements—material, tools, intelligence and labor. If one can deliver only the labor, he furnishes only one-quarter, and is not likely to receive more than one-fourth of the resulfs. If one had a trade and can furnish all of the intelligence, he can furnish one-half, and can fairly demand one-half; but, can the man with the trade furnish all of the intelligence? Seldom! There are lots of things for the proprietor to think out; in fact, I have lain awake too many nights thinking of the difficulties and devising ways to overcome them. So do not make the mistake of thinking that knowing how to do things is all there is to it. People do not care what you know, but it is what can you do? And knowledge helps one to do, but that is all.

It is a great mistake to say that everything is produced by labor, and parents make the same mistake when they tell their children they will never amount to anything if they don't get an education, conveying the idea they can live without work if they get an education.

### The Use of Tools

No matter what education one has, he has got to learn to use the tools. Mathematics is a tool, and education itself is a tool, and the learning to use them is a trade. I believe our educational system will be better when this view is taken of it. Learning to use tools means learning to use them skilfully; but that is not all. We must learn to use them with judgment. I do not like the phrase: "Putting brains in your work," but using them with judgment is an essential feature. Take the exact science of mathematics. In practice it turns out to be about one part science and three parts guessing or good judgment.

Take the case of a steam boiler. A steel boiler shell, properly constructed of steel 1/16 inch thick and 5 feet in diameteter, will stand a pressure of 100 pounds to the square inch; this any of you can figure out. But one boilermaker says you ought to have a factor of safety of four, and he makes it ¼-inch steel plate. Another boilermaker says you ought to have a factor of safety of five; but, as he has no 5/16-inch steel, he makes it ⅜ inch. So, what do you have? One-quarter by figures and three-quarters by guess. Or, to put it better, 1/16 by figures multiplied by from four to six, which experience has shown is best. And so it is with a great many mathematical computations—figured out fine; but on uncertain factors.

Take the case of cast iron, which varies fully 50 per cent. in strength. The best that can be done is to get the general average of the run of the foundry, take the strength of the test pieces and add a big factor of safety. Test pieces of the same size and cast from the same ladle of iron will be different by quite a percentage, and figuring down to the fourth decimal is making a fool of mathematics. Many times complicated mathematics are used in determining things that a simple diagram settle. This is common in determining bridge-strain diagrams.

### The Use of Invention

In mechanical industries there comes a fifth element—invention. Few, I believe, have stopped to think of the part invention and design (another sort of invention) plays in building up the industrial enterprises. At first sight one would fail

to find in the Solvay foundry, which is simply a malleable-iron foundry, much, if any, evidence of invention; but the origin of the thing goes back to the invention of making malleable iron; and sixty years ago the Frazer & Jones Company was composed of Mr. Frazer, an inventor, and a business man, Mr. Burns, a combination that built up a new industry which could not have prospered as it did without Mr. Frazer's inventive ability, and, that grew into the Solvay Foundry Company.

For every industry in the city where a patent has been instrumental in building it up, I have no doubt but there have been a hundred patents taken out—some of merit and many worthless. Some of the meritorious ones died for want of good business management. So that there are good inventions which turn out bad, and some worthless inventions that money changed hands over; but what one man gained, another lost.

Ninety-nine out of a hundred of the young men who catch the inventing microbe have a passport to poverty; and the newly-fledged inventor always makes two big mistakes. He is dead sure someone is going to steal his invention, which they seldom do; and the next thing he is pretty sure to think it is worth millions, while, as a matter of fact, not 10 out of 100 of the patents taken out are worth the paper they are written on.

Learn to invent; learn to design, which is a much rarer faculty; but don't go daft on your invention. While the laborer does the work, the mechanic, the labor, and in part, or wholly, the intelligent direction, the proprietor furnishes the shop and machines, the tools and material, the inventions, and one other thing (and one that seldom appears), the worry, the sleepless nights, and the almost irresistible desire to slight the product. Why does the proprietor worry, and what does he worry over? When to build and how. Where to get the best stock or the cheapest. What machines to buy. What to build? Who is to be foreman? How can the things be improved or built cheaper? Where is the working capital to come from? Are the customers good, and will they pay when they agree? Selling the goods is a big part of the work. So worry makes a sixth point to the six-pointed star, which shines so brightly in the eyes of those who know nothing about the work and worry, money and thought it has taken to produce it.

There is still another thing—character. The ruling powers of a great concern have to maintain agreeable relations with the people they deal with; from those they buy from, those they sell to, with their workmen and their agents, which it is not always easy to do.

It is easy to be good natured when the concern is making money, but when one is losing money it is not easy to put on a happy face or, as Ella Wheeler Wilcox puts it:

"It is easy enough to be pleasant
When life flows along like a song;
But the man worth while
Is the man who can smile
When everything goes dead wrong."

Whatever you do that is worth doing, you have got to work; learn to take an interest in your work; cultivate a love for your work, and to be proud of what you make; and remember Ruskin's remark on viewing a locomotive, which was: "What can the man, who can take iron rust and make it into a locomotive, think of me—making marks on a piece of paper with colored water?"

## Chart for Lewis Formula

By Herbert L. Seward*

The accompanying diagram for the familiar Lewis formula, used in calculating gear teeth, is designed to give a rapid and accurate means of solving the formula when any four of the five quantities $W$, $S$, $P$, $b$ or $y$ entering into it, are known. The diagram also shows to what extent any of the five quantities are modified by a change in others. This formula is not a difficult one to compute from, but it is often desirable to have in chart form, all practical solutions of it and especially a means of knowing, without computation, how a change in pitch, breadth of faces, etc., is going to change stress, etc.

As given by Mr. Lewis:

If $W$ = The load in pounds on the teeth at the pitch circle,

$S$ = The safe working stress, pounds per square inch; depending upon the velocity, as given in the table below.

$P$ = Circular pitch in inches.

$b$ = Length of tooth, usually a given number of times the circular pitch.

$y$ = A coefficient depending on the form and number of teeth.

For the involute and cycloidal systems:

$y$ = 0.10 for 25 to 38 teeth.
= 0.11 for 43 to 100 teeth
= 0.12 for 150 to rack.

Values of S are as follows:

The formula is $W = S P b y$.

If $b$ is given as $K$ times $P$, it becomes $W = S P^2 K y$.

| Speed of teeth, feet, per minute | 100 | 200 | 300 | 600 | 900 | 12,00 |
|---|---|---|---|---|---|---|
| Cast iron | 8,000 | 6,000 | 4,800 | 4,000 | 3,000 | 2,400 |
| Steel | 20,000 | 15,000 | 12,000 | 10,000 | 7,500 | 6,000 |

The chart consists of four parallel scales, one for each of the quantities $y$, $W$, $P$, $K$ and $S$, with a blank scale or center line between. It will be noticed that values of $W$ are found on a set of curves and values of $y$ are represented by a set of parallel lines. The intersection point of any $y$ and $W$ is projected to scale $W$ by means of another system of parallel lines. Both circular and diametral pitch are given and it is interesting to note that these two scales give a convenient means of changing from one pitch to the other. For example, what circular pitch corresponds to a 2¼ diametral pitch? Opposite 2¼ we read 1.39.

If a thread or straight-edge be laid across the figure from any point on the $W$ scales to any point on the $S$ scale, it will cross the center line. Similarly, if the straight-edge be laid from any value of $K$ to the pitch scales it will also cross the center line. It is only necessary to have these two lines (as drawn by the straight-edge) cross the center line at the same point to have the four quantities satisfy, or fit into, the equation $W = S P K^2 y$. Perhaps the best way to use the chart is to have a thin strip of transparent celluloid with a line scratched on the under side of it and a thumb tack in the middle. Having set the line from either $S$ to $W$ or $K$ to $P$ and the thumb tack on the center line, simply turn the celluloid about the thumb tack until the other two quantities come in line.

Since the value of $S$ depends usually on the velocity, the table given at the beginning of this article is placed beside scale $S$, with corresponding values opposite. For example, with a velocity of 900 feet per minute in a steel gear we find $S$ given as 7500. The reader is warned against the mistake of drawing a line from the points in table $V$. It must be drawn from the point on the $S$ scale opposite $V$.

The solution of the example printed at the base of the chart is indicated by dotted lines on the diagram.

It is believed that a chart of this nature is easier to read and more practicable to use than one consisting of intersecting lines. It has been used successfully for some time to check up solutions of problems assigned to students and has proved entirely successful.

*Instructor in mechanical engineering, Sheffield Scientific School.

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In the etching of aluminum the *Brass World* points that the cheapest form is known as the "rubber-stamp process," which can be used on any metal. The process of producing the design on the metal in the form of a resist is the same whatever metal is used, and the only difference will be in the etching liquid. Muriatic acid for etching aluminum is the most satisfactory, as nitric acid will not act upon it. Use 4 parts of water and 1 part of acid and if it works too slowly add more acid. Perchloride of iron may also be used. It is difficult to obtain a very smooth etch on aluminum on account of the nature of the metal.

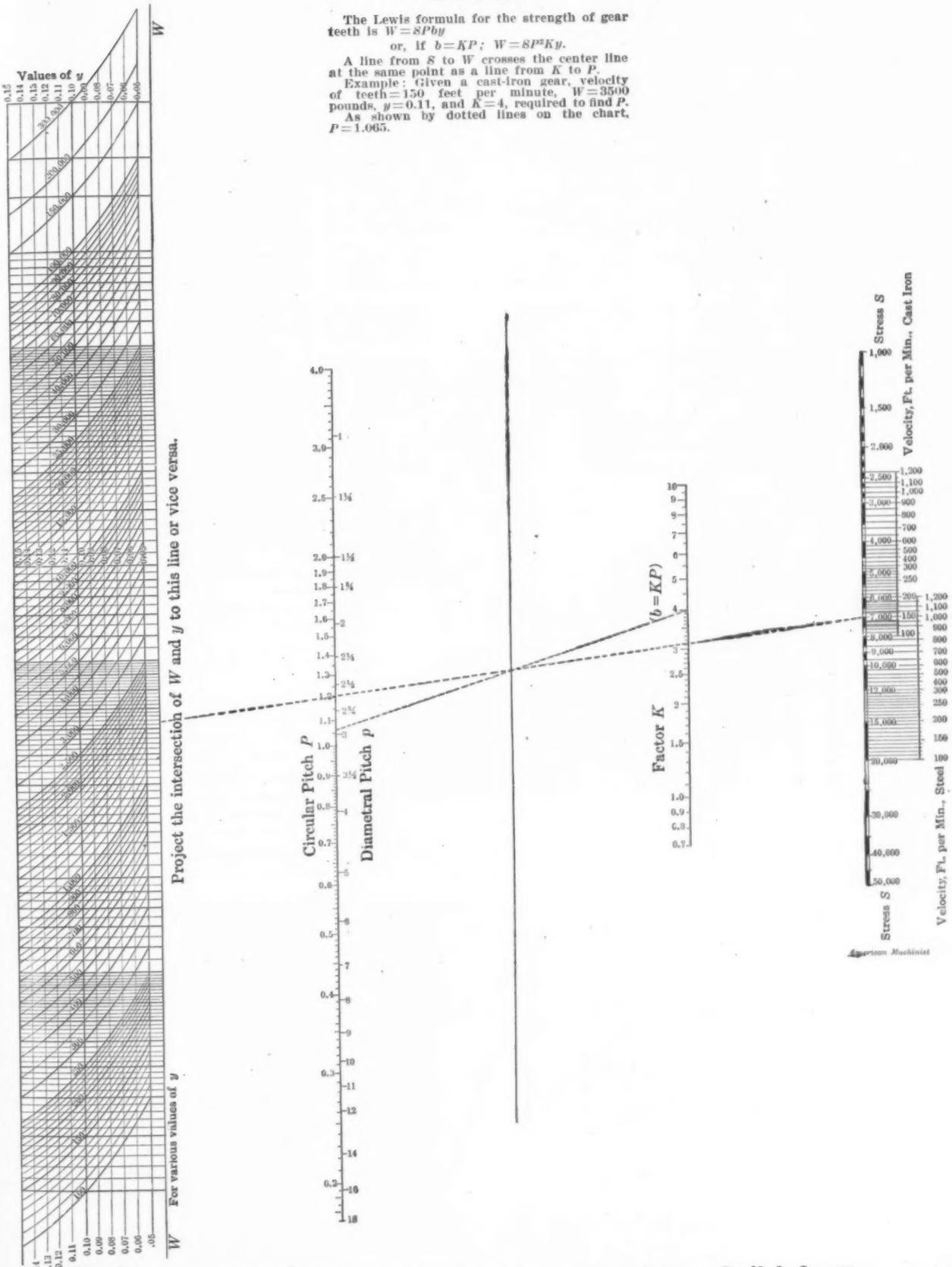
### EXPLANATION

The Lewis formula for the strength of gear teeth is $W = SPby$

or, if $b = KP$; $W = SP^2Ky$.

A line from $S$ to $W$ crosses the center line at the same point as a line from $K$ to $P$.

Example: Given a cast-iron gear, velocity of teeth = 150 feet per minute, $W = 3500$ pounds, $y = 0.11$, and $K = 4$, required to find $P$. As shown by dotted lines on the chart, $P = 1.065$.




DESIGNING CHART FOR STRENGTH OF GEAR TEETH, BASED ON LEWIS FORMULA. BY H. L. SEWARD

# Building the Moline Automobile

By M. E. Hoag

*The tools and methods used in cylinder, connecting-rod and crank-case work.*

*Positive lubrication of cutting tools and fixtures.*

*Use of the Norton balancing machine for crank shafts.*

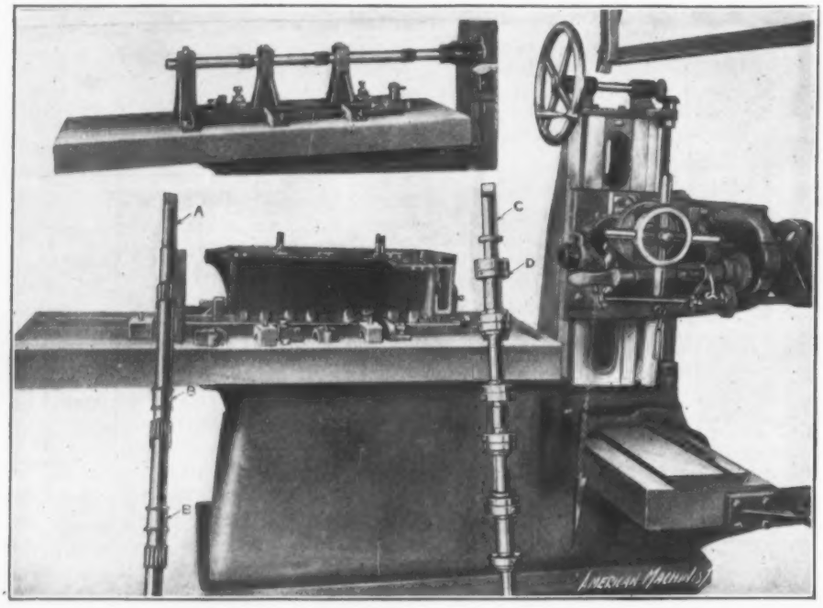
The Moline Automobile Company, of East Moline, Ill., is using some very interesting tools and jigs in its shops.

All of the tools, jigs and fixtures described in this article were designed by Paul Andree, foreman machine department.

### Machining Crank Cases

In Fig. 1 are seen the boring fixture and bars used in boring and facing the bearings in the cast-iron crank cases.

The principal features of interest in this set of tools are the boring and facing bars, the construction of which is seen more clearly in Fig. 2.




Figs. 1 and 2. Boring Crank Cases

The bar *A* carries both the expanding and roughing cutters, and the finishing reamers; and is supported by the hardened and ground tool-steel bushings *B B*, which are prevented from turning on the bar by sliding keys in keyways, this preventing wear on the bars, which is an important item. The facing bar *C* is fitted with bushings similar to those on the boring bar, and in addition, has an adjustable stop collar *D* at the end which controls the length of the bearings.

### Machining Cylinders

The methods and fixtures used in machining the cylinders are a little out of the ordinary; the boring and facing being done at one setting. For this work the cylinders are jigged on a vertical boring machine, and a roughing cut taken over the flange with an inserted-tooth mill. Then with a boring bar fitted with a Davis expanding boring head, they are rough and finish bored, leaving 0.012 inch for grinding, after which the flange is finished with a face mill.

The six bolt holes in the flange are now drilled in the jig shown in Fig. 3, the work being located from the bore of the cylinders. In all future operations, however, the work is located from these bolt holes. Little description of this jig is necessary, the halftone giving a better idea than words. Fig. 4 shows the same jig with work in place ready to drill.

Fig. 5 shows the method of machining the valve chambers and seats, and tapping the two holes *A A*. The work is passed under the tools in the order given. Spindles 1 and 2 rough and finish the opening for the valve cap; spindle 3 bores the lower part of the valve chambores the lower part of the valve chambers, the upper half of the tool acting as a pilot while the lower end is cutting. The work is then brought under spindle 4, and the two holes tapped.

### A Drilling and Tapping Jig

Fig. 6 shows the jig, by means of which seven holes are drilled and tapped in three sides of the cylinders. The body of the jig is rotated to the desired positions and indexed by a plug and bushings. The locating plug is held in contact with the bushings by a coil spring inside of the sleeve *B*, which also serves to withdraw the plug, by means of a pin and the spiral slot *A*, operated by the handle *C*.

### Handling Connecting Rods

The connecting rods are bored and faced in a special machine of standard make, after which they are drilled in the jig shown in Fig. 7, four rods being handled at once under the multiple-spindle drill.

Expansion plugs at *A* hold the lower ends of the rods, and the shouldered

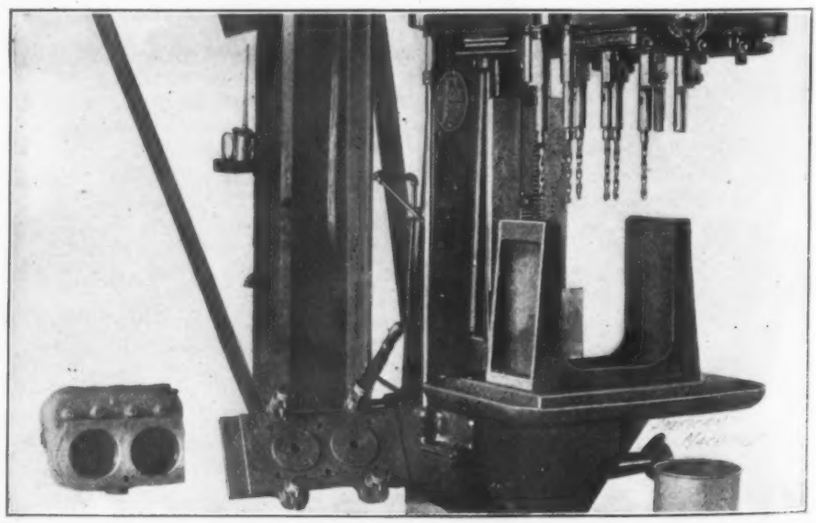


Fig. 3. Drilling Cylinder Bases

bushings *B* draw the upper ends of the rods down to the seats and hold them in place while drilling. A greater turn of the handle *C* engages an interrupted screw on the plug, thus making it possible to handle the work very rapidly.

### Sawing Fixture for Connecting Rods

After drilling, the connecting rods are placed on special arbors in gangs of four, and put in the milling fixture shown in Fig. 8 and sawed. After sawing through the first side the arbors with the rods

Fig. 4. Drill Jig in Use

still in place are turned over and the second side cut.

### A Positive Supply of Cutting Compound

It is the practice in this shop to jig all parts, even for drilled holes that are of little importance so that very little is left to the judgment of the workman; and in machining or drilling work that requires a cutting compound or a lubricant, the distributing pipes are made part of the jig or fixture wherever it is practical to do so, thus insuring a constant and positive supply of compound to each and every tool.

This is a feature that is too often left to the workman, with the result that he either neglects it or else uses up a lot of time rigging up pieces of old pipe and wire every time the job comes along.

### The Valve-grinding Machine

The valve-grinding machine shown in Fig. 9 is of very practical design, is very rapid in action and entirely automatic. The cylinders are placed on the bed plate and located by the flange-bolt holes. The spindles *A*, which carry screwdriver blades in floating holders are then lowered by releasing the plungers *B*, and are held down on the valves by coil springs within the spindle sleeves. Owing to the screwdrivers being held in floating holders they cannot, under any circumstances, bind the valves or throw them off the valve seats.

To remove the cylinders the plugs *C* are withdrawn and held by a pin, which engages a slot in the spindle bearing.

The spindles are driven through a train of gears by the planer shift-belt drive, and are reversed once in about every four revolutions by a pin on the gear *D* striking the shipping rod *E*. The tappets are operated by a cam shaft under the bed of the machine.

With this machine all four valves in a pair of cylinders are ground in 15 minutes.

### Unusual Feature in Crank-case Construction

One of the hardest things to contend with in automobile motors is gear noise. Mr. Andree argues that this is largely due to a change in the center distances, brought about by scraping in the crank and cam shaft. To overcome this the cam-shaft bearings are held in eccentric bushings, which have eight holes in the flange drilled concentric with the outside, and match four drilled and tapped holes in the case. The bushing being bored 0.005 inch off center, it will be readily seen that a variation of 0.010 inch may be obtained between centers by turning them from one extreme to the other, and by moving one hole 0.00225 inch variation is obtained.

When testing the engine, if the gears are not quiet, the bolts are loosened and

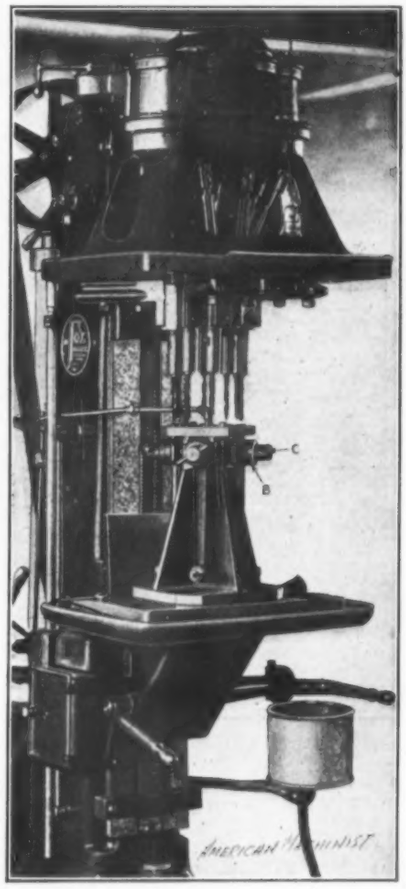


Fig. 7. Drilling Connecting Rod Ends. Note Oil Pipe in Top of Jig

the bushings turned until the gears run quietly. This company is also using a number of the latest foreign ideas in motor design.

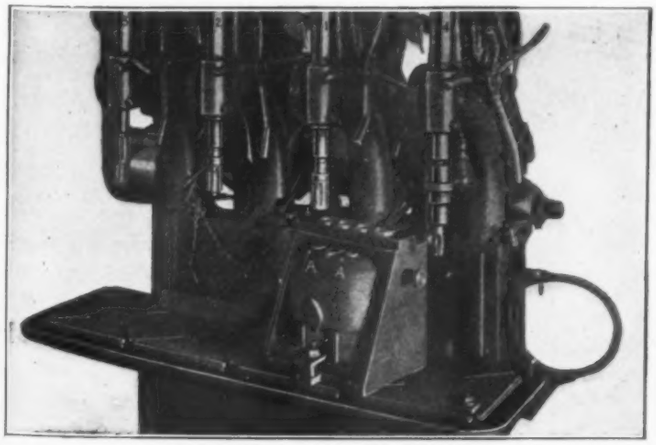


Fig. 5. Drilling and Reaming Valve Holes

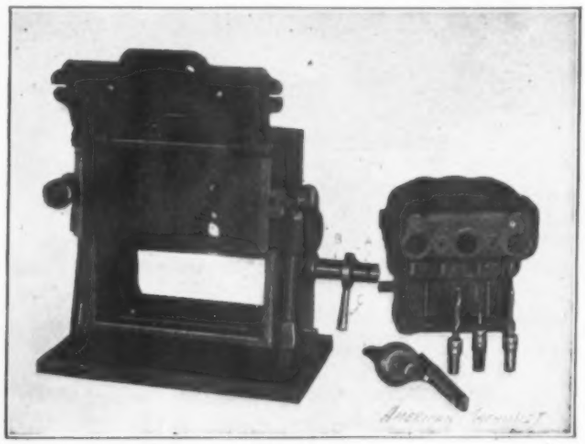


Fig. 6. Drilling and Tapping Fixture for Cylinders

### All Rotating Parts Given a Running Balance

Another uptodate feature in this shop is the Norton running balance machine, which is shown in Fig. 10, with a crank shaft ready to test. This machine was so fully described in a recent number of the American Machinist that no details are necessary. With this machine all rotating parts are tested and given a running balance, which tends largely to the quiet and smooth running of the motor.

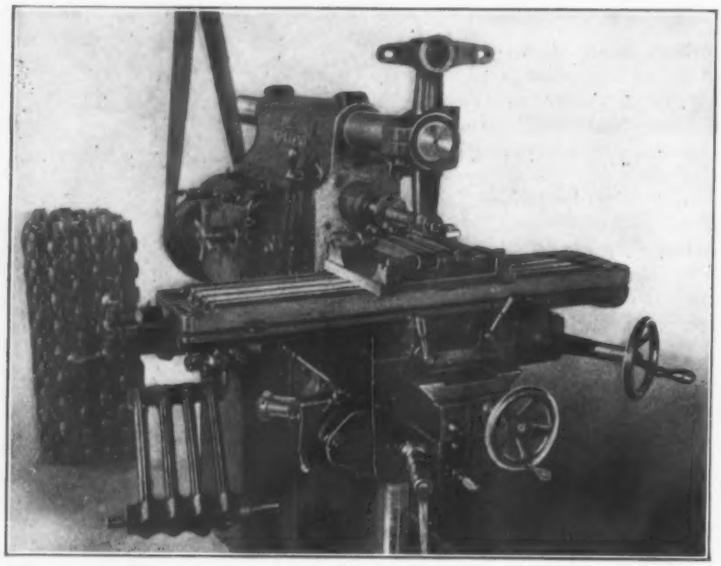


Fig. 8. Milling Connecting Rods

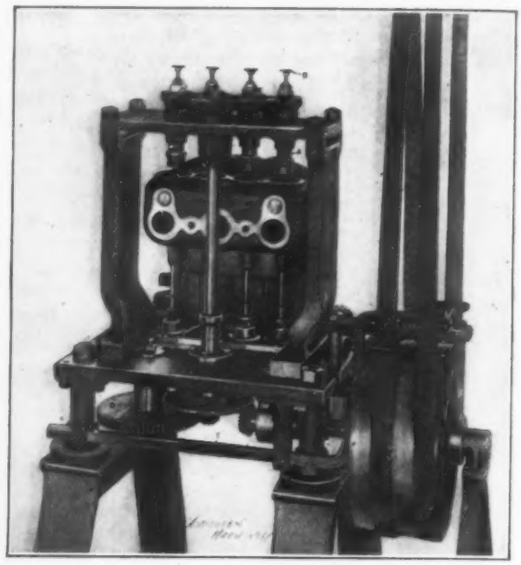


Fig. 9. Valve Grinder

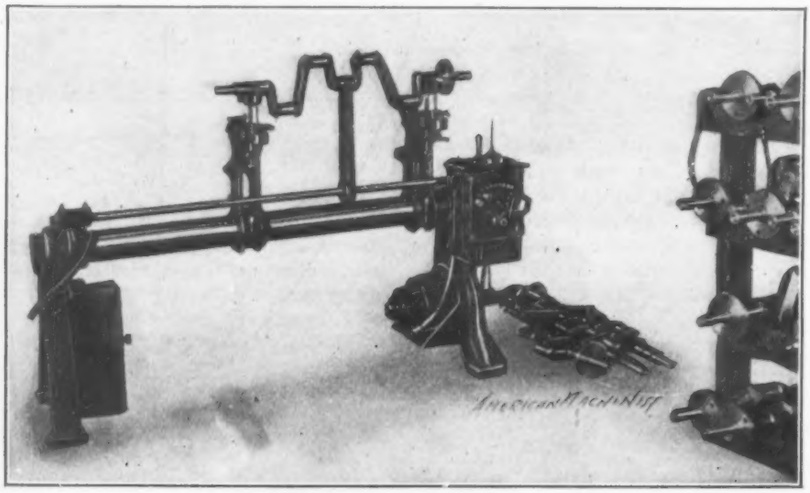


Fig. 10. Norton Balancing Machine in Automobile Work

According to the *Brass World* the addition of rosin in a small amount to a caustic potash solution will hasten its action upon oil or grease, particularly in the removal of the mineral brands of oils and slushes.

## A Time Saver That Did Not Save

By C. A. Clandery

Some time ago Professor Sweet wrote of the seeming indifference of workmen in nearly all branches of the trade to take advantage of labor-saving kinks, and after reading his statement for the second time that probably no draftsman ever made a templet to draw radii and fillets it seemed that his accusing finger was pointed directly at me. Possibly I took it to heart more than the average because "he brought me up" and I had not got entirely by the feeling that I should do as I was told. Besides that, and to make the confession complete, I was fired by ambition to be the only one that was actually profiting by the advice. I purchased a good sized sheet of celluloid and ran over in my mind all the different kinds of those labor eradicators that I was going to make.

Nearly a month rolled by and I came to the realization that I was no nearer the coveted honors than before and when I looked over the elapsed time and could not discover much wasted I made up my mind that I knew why so many of these contrivances were not in general use.

In casting around for the most available thing it seemed that a small 30-degree angle was the nearest and as three corners or rather curves were preferable to none and anyway got three fourths nearer the desired result I carved them to three different radii with my penknife and polished them with the pencil file, beveling down to a thin edge so I would not have to hold the pencil perpendicular to get good results in the proposed high-speed and quick-change operations that I felt sure was going to materialize.

There was also a little addition to the original proposition in the way of a small 30-degree notch cut in the inside which showed up as a decided improvement in making threads.

I was working on tool drawings so I oiled up the drafting machine, got the eradicator in action, and locked up the bow pencil as being superseded.

But I am in doubt as to its time saving qualities as I have been unable to answer the tracer's question as to how he was going to keep up his reputation for speed when he had to stop and put in all the radius centers on those drawings of mine.

A cubic foot of ice will weigh about five pounds less than a cubic foot of water.

## Direct and Indirect Office Lighting

The use of both direct and indirect lighting in the office building of the fine new plant which the Kempsmith Manufacturing Company has erected in Milwaukee, gives an excellent opportunity to compare the effectiveness of the two methods.

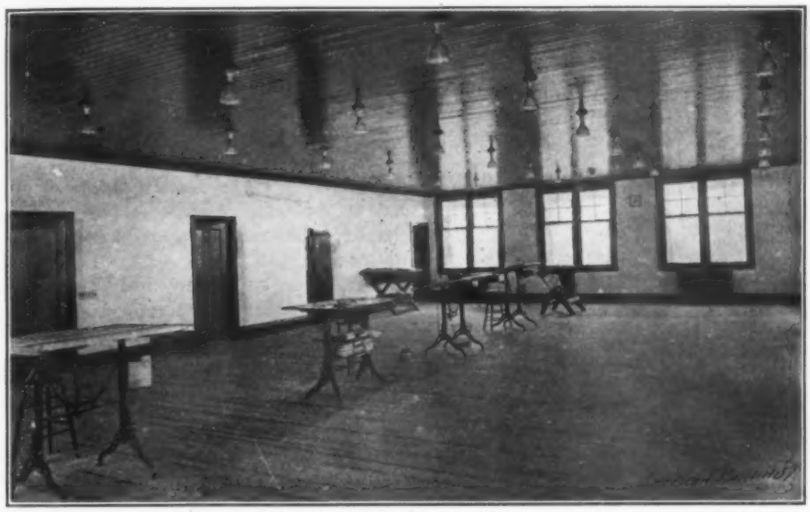


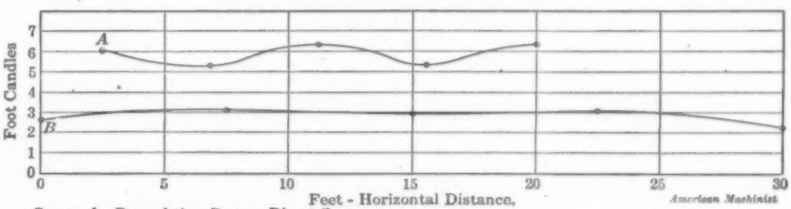
FIG. 1. DIRECT LIGHTING IN DRAFTING ROOM

In the drafting room, which is shown in Fig. 1, the illuminating is direct, the provision of light being very liberal. The lamps used are 60-watt, bowl-frosted, tungsten Mazda lamps, spaced at 6½ feet apart and fitted with Holophane globes.

In the chief engineer's private office, and in the business office, the latter shown in Fig. 2, the indirect system has been installed. Each unit consists of four 60-watt, Mazda lamps, having a reflector below which throws the light upward, and an opaque fixture below to cut off the direct light.

Fig. 3 shows the comparative uniformity of the intensity of the illumination. At the bottom of the diagram is a scale of feet measured across the rooms, the hight of the curves showing the intensity of the illumination in foot candles measured horizontally. The curve from the general offices will be seen to be almost a straight line, while that from the drawing office is distinctly wavy.

In a more general way the illumination in both cases is extremely satisfactory and has been pronounced the most beautiful installation in Milwaukee.




Curve *A* - Draughting Room - Direct System.
Curve *B* - General Office - Indirect System.

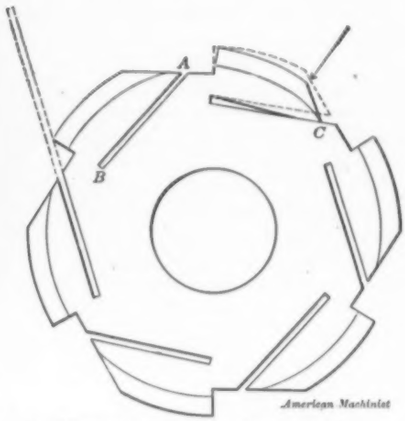
FIG. 3. COMPARATIVE VALUE OF TWO SYSTEMS

FIG. 2. INDIRECT LIGHTING IN THE OFFICE

## A Simple Formed Cutter

BY F. P. STEVENS

While the little kink herewith described may have been published before, I have never heard of it, nor have I ever seen it in use anywhere else. An old watchmaker happened to be visiting the shop in which I am employed just in time to see me considering what would be the easiest way to make a cutter to mill the teeth in 50 clock wheels. It was not likely that the cutter ever would be needed again, but these wheels must be clean-cut. The watchmaker described his way out of the difficulty as follows:




A KINK IN RELIEVING CUTTER TEETH

Turn up the blank with the proper tooth profile and mill the cutting faces in the usual way, but only six or seven in number. Then saw a slit under each tooth, from its back to a point just under the cutting face, that is, from *A* to *B*. With a blunt broach, or other tool, knock in the tooth until the saw cut just closes at the outer end, as shown at *C*. This relieves and clears the tooth perfectly, and gives that desirable property, though not needed in my own case, of admitting the repeated grinding of the faces of the teeth without changing their profile. Harden in the usual way. The amount of relief is regulated within considerable range by the thickness of the saw slit.

The teeth of this cutter are surprisingly strong and a little care in knocking them in insures the cutter's making a cut very close to its own thickness.

# Some of the Details of Jig Making

By Lucian Haas*

*Showing such details as Swinging Ends; Jack Pins and Screws; Drilling Angles and Blocks; Stationary and Adjustable Stops; Indexing Pins and Methods and Wedges.*

*These are carefully considered and suggestions given as to the selection of the best methods to be used for different kinds of work.*

Drill jig lids are divided into two classes, removable and swinging. There are a great many ways of designing them and very many points in the construction of them are too often overlooked.

Figs. 1, 2, 3 and 4 are good examples of everyday practice in designing or making removable lids. Figs. 1 and 2 are very similar. Where extreme accuracy is to be maintained for a very great length of time, Fig. 1 answers nicely. Hardened plugs are driven in the jig body and lid. They accurately locate the lid as well as prevent wear.

On large jigs, means should be provided for removing the lid. In some instances an eye bolt *B* is provided as shown in the illustration.

In Fig. 2 will be found the general practice and attention here is called to the dirt groove which is so often overlooked, and it will be found of advantage to rib these lids whenever possible, either on top or bottom.

Figs. 3 and 4 are very much alike. In Fig. 3 the stud is made large enough to allow the lid to be removed without taking off the nut. The nut is simply loosened and the slip washer removed. In Fig. 4 the lid is located by means of the

*Chief tool designer, Thomas Motor Company. Copyrighted 1911, by Lucian Haas.

absolutely necessary as the longer the studs the more difficult the operation of removing the lid.

Figs. 5 to 12 show a few examples of

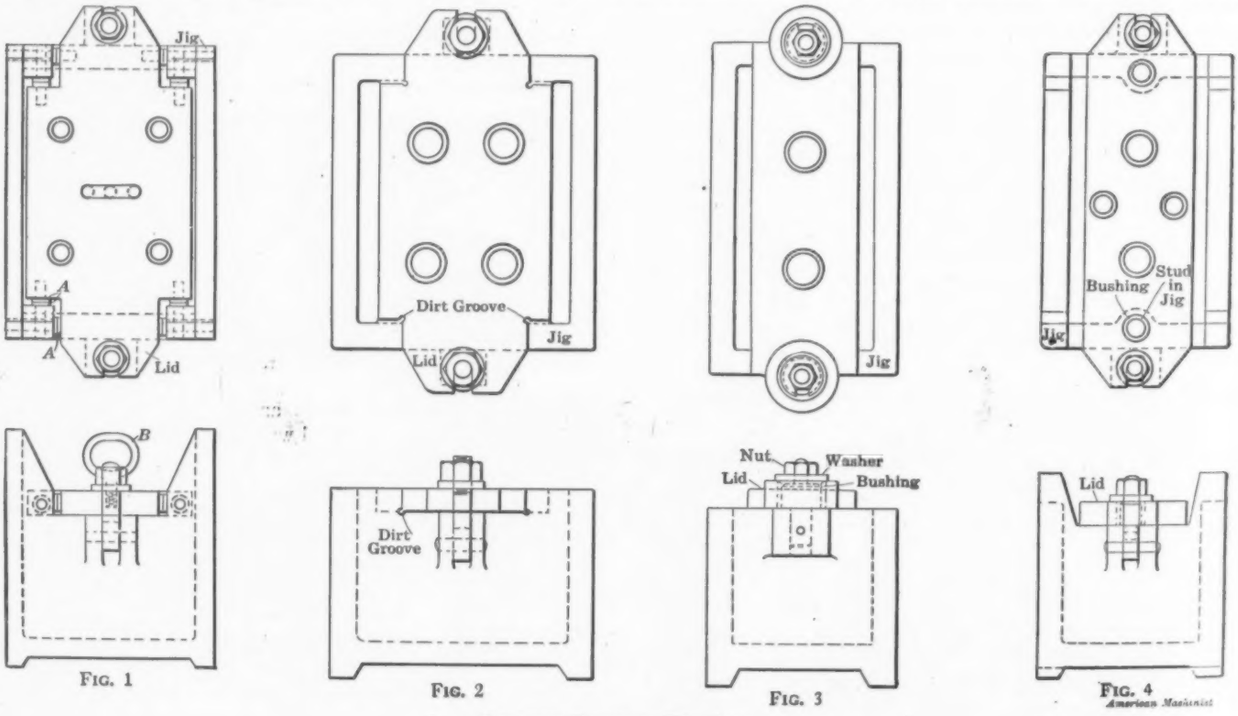



FIG. 1 FIG. 2 FIG. 3 FIG. 4

SEVERAL FORMS OF BOX JIGS

two studs similar to Fig. 3, but to remove the lid, the two eye bolts are released and swing out of the way. It is always advisable to harden the studs in both cases and provide hardened bushings in the lid for them to work into. As a word of caution do not make the studs any longer than is

swinging lids. Fig. 7 is an improvement over Fig. 5, on account of the hardened-steel bushings. Its wearing qualities are doubled and its accuracy maintained.

Fig. 8 is an improvement over Fig. 6 and is probably the most commonly used.

Fig. 9 illustrates a method of securing

the opposite end of a swinging lid and takes the place of the eye bolt as shown in Fig. 10. Hardened-steel bushings are placed in the jig body and in the lid. The pin being a sliding fit holds the lid properly. Attention may be called to the designing of the lug in Fig. 10. The lug acts as a support for the bolt and seat for the lid. In this construction there is no danger of the lid being broken or sprung out of shape in case the operator puts an excessive amount of strain on the bolt.

Fig. 11 is made similar to Fig. 1, it having the inserted studs *A* for keeping the lid in alinement and also increasing its wearing qualities.

Fig. 12 is an improvement over Fig. 7. The bushings are so designed to take up the wear on the pin as well as the sides of the lid. This design is expensive and only used where continued accuracy is required.

### JACK SCREWS AND PINS

Figs. 13, 14, 15 and 16 are examples of jack screws which are used for supporting the part to be drilled. They are also used for taking up the thrust of the drill. Figs. 13 and 16 are the most commonly used style of screws. The jack screws

are, however, in many instances superseded by the jack pins for the reason that the jack screws must be adjusted very carefully to prevent springing or distorting the work, and chips, oil or dirt working its way into the threads prevents it being operated quickly, etc.

While the jack screw has its disadvantages, so has the jack pin, but these disadvantages can always be attributed to their design. A number of illustrations showing different methods of making them will be found in Figs. 17 to 24 inclusive. It is unnecessary to explain the operation of all of them as they speak for themselves, but a word of caution to the designer or maker, is essential.

Fig. 17 is not protected from chips, but in most cases it has a nurled or winged head. This design is apparently correct but it has some bad features.

The power of a screw is too often misjudged by the designer as well as by the machine operator who is to use the device. Here we have the powerful action of the screw as well as the wedge action of the conical end of the screw against the inclined surface of the plunger pin, therefore very little pressure on the screw will hold it out and allow the plunger pin to drop.

Figs. 23 and 24 show two ways of operating and holding two plunger pins.

Jack screws are generally made of cold-drawn steel and case hardened. Jack pins are usually made of tool steel and hardened, although if made of cold-drawn steel and properly case hardened their wearing quality is very high. Always provide dust caps where possible.

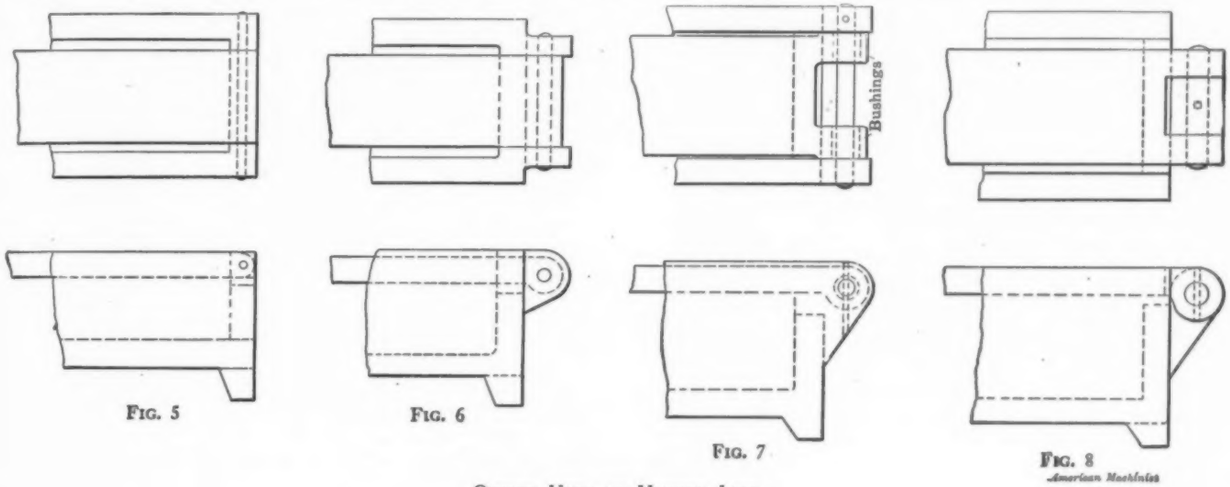



FIG. 5 FIG. 6 FIG. 7 FIG. 8

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OTHER USES OF HINGED LIDS

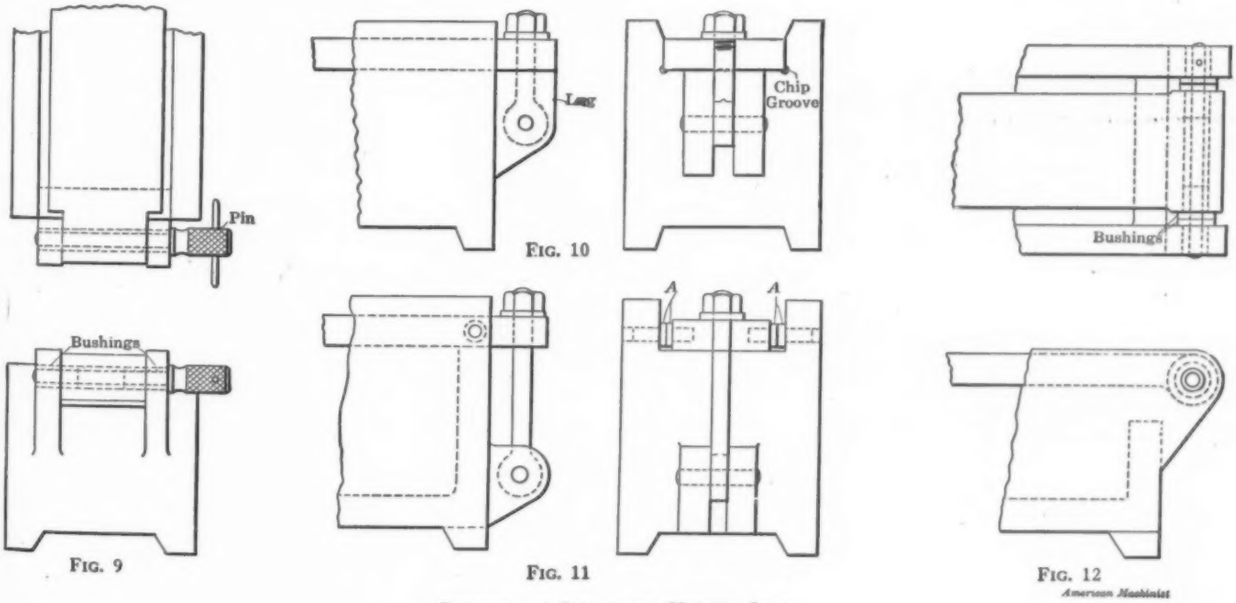


FIG. 9 FIG. 10 FIG. 11 FIG. 12

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DETAILS OF JIGS WITH HINGED LIDS

powdered metal or dirt entering the sides of the pin. This will, therefore, be apt to soon get out of order and the pin stick in the hole provided for it.

Fig. 18 is protected from the chips, dirt, etc., by means of a cap. It is operated by a spring and held in position by the screw which strikes the tapered part of pin.

Fig. 19 is operated by means of a cone-pointed hardened screw. The illustration shows the screw having a square head is sufficient to spring a good-sized casting several thousandths of an inch.

Fig. 22 is similar to Fig. 19, but in this case it is operated by means of a wedge-shaped pin which in turn is operated by a spring. The illustration shows the plunger pin at its extreme hight. To loosen the plunger pin, the wedge-shaped pin is pulled out as far as it can be and the knob turned half way around. In so doing the bottom flange of the knob will rest on the head of the small pin *A* which

### DRILLING ANGLE AND BLOCKS

It is, of course, essential to have the drill jig as light as possible, making the designing of it (in case a hole is on an angle or out of square with other holes) very difficult in many cases. For this reason we have what is called an angle block, such as is shown in Fig. 25.

This block is generally made of cast iron and provided with legs in the bottom, similar to the drill jig. The illustration shows a jig resting in the block.

An adjustable drilling angle is shown in Fig. 26. One or two of these drilling angles in a large factory are sufficient to take the place of a great number of angle blocks.

The plates *A* and *B* may be made of cast iron, ⅞ inch thick, $C = \frac{3}{8} \times 1\frac{1}{4}$ cold drawn steel, $D = \frac{1}{2}$-inch bolts. The greatest angle of *G* is about 75 degrees and the smallest 30 degrees. These drilling angles should be made up in two sizes for the large size $F = 8$ and $E = 12$ inches and for the small size $F = 6$ and $E = 10$ inches.

### Stationary or Adjustable Stops

Ninety per cent. of the drill jigs designed and made have some form of stops. They may be stationary or adjustable. These stops, or (as they are sometimes called) locating points, are used for properly locating the piece in the jig so that the holes will when drilled be in the right position. Figs. 27, 30 and 31 are permanent or stationary stops and Figs. 28 and 29, adjustable stops.

It is always good practice to make these stops stationary whenever possible as the adjustable ones very often work loose and result in spoiled work. They also furnish a good excuse for the operator who was careless in placing the part in the jig. For if the holes are drilled so that the part is spoiled, he can easily reset the adjustable stops and blame an innocent party.

Fig. 31 is a form of stop screwed and dowel pinned to the jig. This style is made up in many different ways.

They are usually made of tool steel, and hardened. In some cases they are made of cold-drawn steel and carbonized or case-hardened, and at times they are made part of the jig.

In designing all stops similar be sure to allow clearance for dirt, chips, etc.

### Indexing Pins and Methods

For the indexing of revolving or rotary drill jigs, the indexing method is governed by the design of the jig as well as the accuracy to be maintained in the spacing or location of the holes to be drilled. In the following illustrations will be found a few examples of indexing methods and the designer can select the one best suited for the work.

Figs. 32 and 33 will give the best results and may be used where extreme accuracy is required. The index pin in both cases makes this positive.

Fig. 32 has the advantage in not having to remove the index pin and, therefore, it

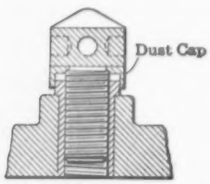

Fig. 13

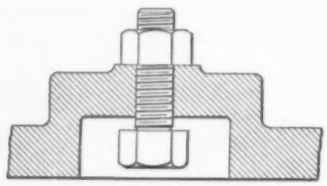
Fig. 14

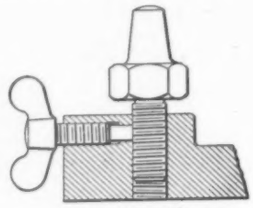
Fig. 15

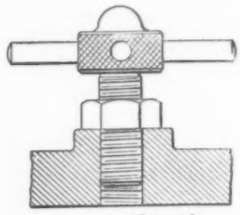
Fig. 16

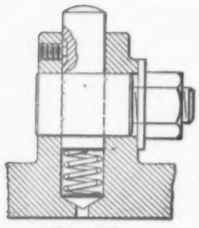
Fig. 17

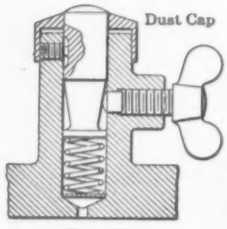

Fig. 18

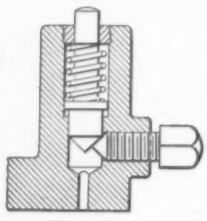
Fig. 19

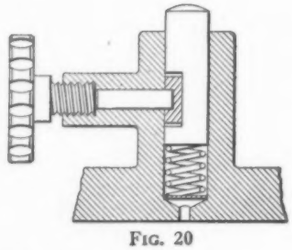
Fig. 20

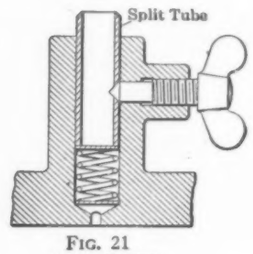

Fig. 21

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Stop Pins, Studs and Screws

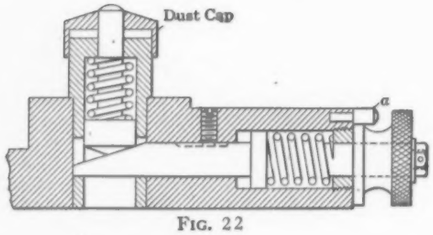
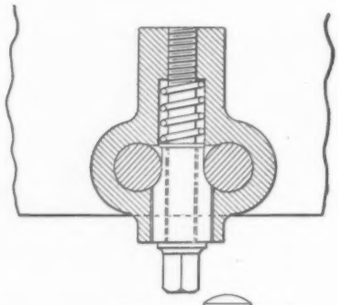


Fig. 22



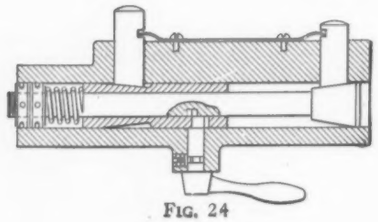


Fig. 24

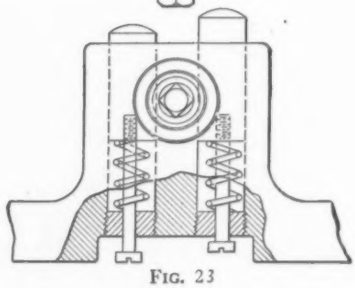


Fig. 23

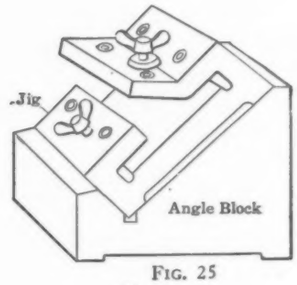


Fig. 25

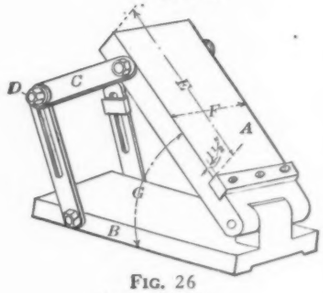


Fig. 26

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Locating Pins and Angle Plates

can be operated more quickly. Many tool designers make the end of the index pin tapered and place corresponding bushings in the revolving member, but this has many disadvantages. In the first place it would be absolutely necessary to design

FIG. 27

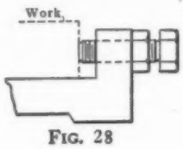

FIG. 28

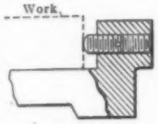

FIG. 29

FIG. 30

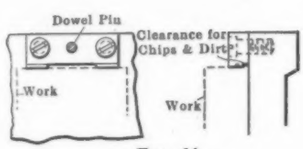

FIG. 31
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END STOPS FOR WORK

the jig so that there would be no danger of chips of iron or dust or dirt entering the tapered bushings, which would prevent the pin properly seating itself. Again, the compound generally used in the drill-press department soon works its way into the bearing which supports the revolving member and when the jig is not in use becomes hard or thick and thus prevents the member from freely turning, which causes considerable trouble in getting the pin to properly seat itself.

Figs. 34 and 35 are designs frequently used when there is not a great amount of accuracy required. They are equally good and in both cases the indexing slots and fingers are operated in a similar manner.

Fig. 36 probably originated from Figs. 32, 33 and 35. The index pin, however, is more durable than the index fingers.

### WEDGES

The wedge is one of the simplest means of holding work in the drill jig, known to the tool designer or maker, and therefore needs very little explanation.

They, like the cam, have a limited amount of movement, and should only be used where the variation in the size of the piece is within this amount.

Wedges are made up of square and round steel as shown in Fig. 37 and 38. The amount of taper *A* given them varies 4 or 5 degrees will give the best results.

Figs. 39 and 40 show two styles of wedges which are operated by means of a screw, and held in position with gibs or screws.

#### FORMULA

$R$ = Radius,

$C$ = Fulcrum of lever,

$E$ = Amount of eccentricity = $0.001 \times 2 \times 90$,

$B = E$,

$D$ = Number of degrees of total eccentricity. 0.001 inch $\times R \times D = 2 \times E$.

0.001 inch rise for every 1 degree when radius is 1 inch.

In making these cams maintain a limit of 0.005 to 0.010. To lay them out, convert $E$ into the nearest fraction and scribe radius $R$. The result will be close enough for jig work.

#### EXAMPLE NO. 1

What is the amount $E$ and total amount

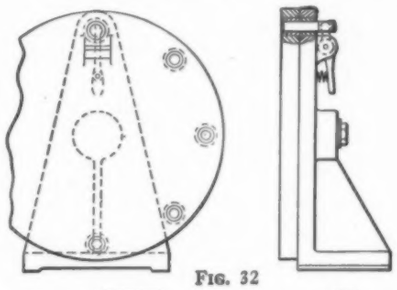
FIG. 32

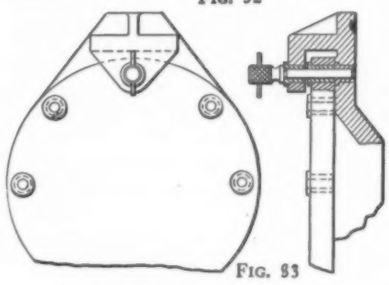
FIG. 33

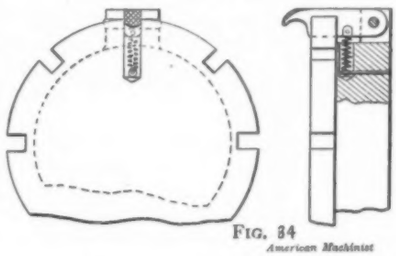
FIG. 34
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INDEXING MECHANISM

$D$ of eccentricity in a lever having a 1-inch radius?

0.001 inch
1 inch radius

0.001 inch rise of 1 degree
90 number of degrees

0.090 inch = E
2

0.180 inch = D

0.001 inch
1 inch radius

0.001 inch rise of 1 degree
180 total number degrees

0080
001
00.180 inch = D

#### EXAMPLE NO. 2

What is the amount of $E$ and total amount $D$ of eccentricity in a lever having a 1½-inch radius?

0.001
1.5 inch

0.0015 inch
90

0.1350 inch = E
2

0.2700 inch = D

0.001
1.5 inch

0.0015 inch
180

0.1200
0.15

0.2700 inch = D

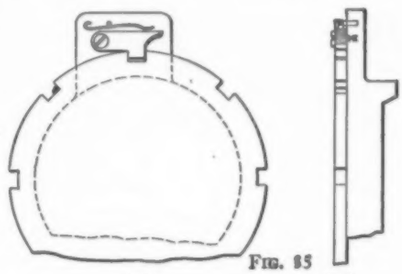
FIG. 35

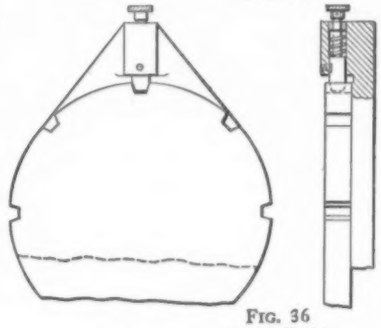
FIG. 36
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INDEX LATCH AND FINGER

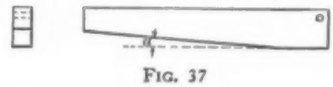
FIG. 37

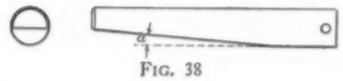
FIG. 38

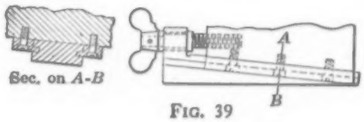

FIG. 39

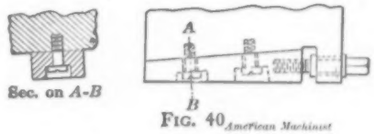

FIG. 40
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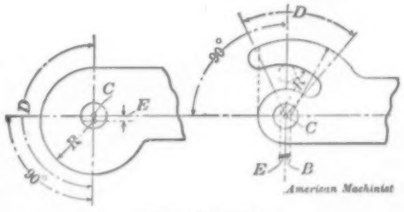
USING THE WEDGE




CAM LOCKS

# Advantages of Abandoning All Gages

By George E. Goddard

*Many do not realize the cost of the confusion that now exists in regard to the use of the variety of gages for sheet metal, wire and tubing.*

*The abandonment of all gages and the use of decimal measurements has been recommended by two national societies and would save much time and money.*

The subject of wire and sheet-metal gages has probably caused more misunderstandings and consequent unpleasant correspondence than any other subject in manufacturing industries. This may seem to be a sweeping statement, but after considering the following, a great deal of which has been taken from handbooks and manufacturers' catalogs, it will be conceded, I think, by even those who have but little occasion to use gages, that the subject demands concerted attention in order to settle upon a permanent release from such inconveniences.

Broadly speaking, the majority of gage troubles arise from three sources: The existence and use of so many different gages; information in regard to which gage is used being incomplete and of an indefinite nature; the absurdity of many gages in reading to six decimal places, and the commercial impossibility of attaining anywhere near such accuracy. The Government recognizes but one gage —the United States Standard gage for sheet and plate, iron and steel. The adoption of this gage served little to help matters, although a variation of 2½ per cent. is allowed, which was the first step toward limit tolerances.

### Abandon All Gages

The legalization of the standard sheet-metal gage of 1893, and its adoption by several manufacturers of sheet metal, has only added to the existing confusion. A joint committee of the American Society of Mechanical Engineers and the American Railway Master Mechanics' Association in 1895 agreed to recommend the use of a decimal gage; that is, a gage whose number for each thickness is the number of thousandths of an inch in that thickness, and also to *recommend the abandonment and disuse of the various other gages now in use,* as tending to confusion and error. The Westinghouse Electric and Manufacturing company abandoned the use of gage numbers in reference to wire and sheet metal about this time.

Here it might be stated that if more manufacturers had adopted or would adopt the decimal gage, it would greatly facilitate matters, but they have been in use so long that it seems to be next to an impossibility for manufacturers to omit the gage number.

Brown & Sharpe have evidently had their troubles before now, as is evidenced by the earlier editions of their small catalogs. It is hard to say why this is omitted in the later editions; it must be they have given up in despair, for it certainly is not that the trouble has been so far remedied not to need explanation of that kind. As taken from their catalog, 1906 edition, it reads as follows:

### Some of the Troubles

"Referring to the annexed tables, we would call attention to some of the absurdities and anomalies of the present system of gages denoted by numbers.

"A perusal of these tables should satisfy us that we have a sufficient variety to choose from and ample refinement when we get down to one-millionth of an inch, which is the final figure in some cases.

"In some cases the difference between two numbers falls as low as two one-thousandths of an inch; in others it is only one-thousandths, etc.

"It may be possible to make one gage to any of these standards which shall be so accurate as to defy the detection of an error, and with the same care it may be possible to make a thousand such gages, but every mechanic and every person accustomed to making accurate measurements of the best work knows that it is simply impossible to obtain absolute accuracy in such pieces of work when produced in quantities.

"It is impossible commercially on account of the cost, and that settles the question.

"Everyone knows of the wonderful accuracy of the 'Whitworth' gages, and also their enormous price, which makes them almost unsalable.

"In regard to ordinary wire gages, they are notoriously inaccurate."

### Troubles of the Mill Man

Another firm says:

"We have two new gages in our possession which were kept in our office for purposes of comparison, and to prevent wear they were not allowed to go into the mills. In a recent case a sample under discussion measured on one gage 'tight' twenty-three and on the other 'tight' twenty-four, and our customer said it was neither by his gage, and didn't suit him anyhow.

"One of our new gages has its No. 23 so much larger than its No. 22 that the difference can be easily detected by the naked eye, yet No. 23 ought to be two to four thousandths smaller than No. 22.

"If we were to roll No. 23 by that gage how would our customer get what he wanted, unless his gage accidentally contained the same blunder? Yet, our gage is a new one, stamped with the maker's name; and cost about $6.

"Another trouble is with the wearing of the gages, for which there is no remedy, and we imagine that no man ever throws away a gage because it is worn out; on the contrary, it represents an outlet of $6; he is used to it; he measures everything by it, and he is mad when anything does not measure to suit it. A still more serious difficulty arises from a very common mode of ordering. We frequently have orders for such a gage, 'light' or 'tight,' 'full' or 'scant,' 'heavy' or 'easy,' or such a number and one-half; for instance, 15½.

"This latter is terribly confusing to a roller; he almost always takes it to mean that it is to be thicker than the whole number, and is pretty certain to make 14½ for 15½ if he is not warned beforehand.

"Then, in regard to the terms 'light,' 'easy' etc.; we have, for instance, the differences between Nos. 27 and 28, in the three systems, as follows: 0.00225, 0.002, 0.001554, or two hundred and twenty-five one hundred-thousandths, two one-thousandths and fifteen hundred and fifty-four millionths. How is it possible for a roller to know just how many millionths of an inch another man, whom he never saw, means when he says No. 28 'full,' or No. 27 'easy,' and how is he to guess how many thousandths of an inch the other man's gage is wrong in its make, or how many hundredths it has worn in years of steady use? This is no fancy sketch; the above are every-day difficulties in this age, when every man knows just what he wants and will have nothing else, and yet has no better way of telling his wants than to say, 'I want such a gage tight,' when probably his gage differs from every other gage that was ever made.

"There is a very easy and simple way out of whole snare, and that is to *abandon fixed gages and numbers altogether.*

"The micrometer sheet-metal gages made by the Brown & Sharpe Manufacturing Company, of Providence, R. I., cost less than a common gage, or no more. They measure thousandths of an

inch very accurately, and even a quarter of a thousandth may be neatly measured.

"They are very simple, so that any boy of ordinary intelligence can be taught to use one in a very few minutes. They have every arrangement for readjustment when worn considerably, they can be used accurately, without adjustment, by making allowance for the error in reading at the zero line.

"We find that mechanics like to work to them, and that there is little trouble to get sheet rolling done to within a thousandth of an inch on fine sizes.

"Our works are fully supplied with these instruments, and we *urge all parties in ordering to give us dimensions and not numbers.*

"We cannot now recall a single case of serious complaint having arisen where we have had dimensions expressed in decimals to work to."

| Roebling's, Washburn's and Moen's. | | Stubs Steel Wire. | | (B. W. G.) Birmingham or Stubs Iron Wire. | | Proposed Decimal Limit Gage. | B. & S. American or Brown & Sharpe. | | U. S. Standard Sheet and Plate, Iron and Steel. | | Morse Steel Wire, Also Twist Drill. | | British Imperial Wire. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Inch. | No. | Inch. | No. | Inch. | Inch. | No. | Inch. | No. | Inch. | No. | Inch. | No. | Inch. |
| | | | | 35 | 0.005 | 0.005 ± 0.00025 | 36 | 0.005 | | | | | 40<br>39 | 0.0048<br>0.0052 |
| 35<br>34 | 0.0095<br>0.0104 | | | 31 | 0.010 | 0.010 ± 0.0005 | 30 | 0.010025 | 32 | 0.0105625 | | | 32 | 0.0108 |
| 30<br>29<br>28 | 0.014<br>0.015<br>0.0162 | 79<br>78<br>77 | 0.014<br>0.015<br>0.016 | 28<br>27 | 0.014<br>0.016 | 0.015 ± 0.001<br>(1.64 — ) | 27<br>26 | 0.014195<br>0.01594 | 28 | 0.015625 | 79<br>78 | 0.0145<br>0.016 | 28 | 0.0148 |
| 25 | 0.0204 | 75 | 0.020 | 25 | 0.020 | 0.020 ± 0.001 | 24 | 0.0201 | 26<br>25 | 0.01875<br>0.021875 | 76<br>75 | 0.020<br>.021 | 25 | 0.020 |
| 23 | 0.0258 | 72<br>71 | 0.024<br>0.026 | 23 | 0.025 | 0.025 ± 0.001 | 22 | 0.025347 | 24 | 0.025 | 73<br>72<br>71 | 0.024<br>0.025<br>0.026 | 23 | 0.024 |
| 22<br>21 | 0.0286<br>0.032 | 69<br>68<br>67 | 0 029<br>0.030<br>0.031 | 22<br>21 | 0.028<br>0.0302 | 0.030 ± 0.0015<br>(1.32 — ) | 21 | 0.028462 | 23<br>22 | 0.028125<br>0.03126 | 70<br>69<br>68 | 0.028<br>0.0283<br>0.031 | 22<br>21 | 0.028<br>0.032 |
| 20 | 0.0348 | 65<br>64<br>63 | 0.033<br>0.035<br>0.036 | 20 | 0.035 | 0.035 ± 0.0015 | 19 | 0.03589 | 21 | 0.034375 | 66<br>65<br>64 | 0.033<br>0.035<br>0.036 | 20 | 0.036 |
| 18 | 0.0475 | 56 | 0.045 | | | 0.045 ± 0.002<br>(3.64 — ) | 17 | 0.045275 | 19 | 0.04375 | 57<br>56 | 0.043<br>0.0465 | 18 | 0.048 |
| | | 54 | 0.055 | | | 0.055 ± 0.002 | 15 | 0.057068 | 17 | 0.05625 | 55<br>64 | 0.052<br>0.055 | 17 | 0.056 |
| 16 | 0.0625 | 52 | 0.063 | 16 | 0.065 | 0.065 ± 0.0025<br>(1.16 + ) | 14 | 0.064084 | 16 | 0.0625 | 52<br>51 | 0.0635<br>0.067 | 16 | 0.064 |
| 15 | 0.0719 | 49<br>48<br>47 | 0.072<br>0.075<br>0.077 | 15 | 0.072 | 0.075 ± 0.003 | 13 | 0.071961 | 15<br>14 | 0.0703125<br>0.078125 | 49<br>48 | 0.073<br>0.076 | 15 | 0.072 |
| | | 44<br>43 | 0.085<br>0.088 | 14 | 0.083 | 0.085 ± 0.003 | | | | | 45<br>44 | 0.082<br>0.086 | 14 | 0.080 |
| 13 | 0.0915 | 42<br>41<br>40<br>39 | 0.092<br>0.095<br>0.097<br>0.099 | 13 | 0.095 | 0.095 ± 0.004<br>(3.32 + ) | 11 | 0.090742 | 13 | 0.09375 | 42<br>41<br>40 | 0.0935<br>0.096<br>0.098 | 13 | 0.092 |
| | | 36<br>35<br>34<br>33 | 0.106<br>0.108<br>0.110<br>0.112 | 12 | 0.109 | 0.110 ± 0.004<br>(7.64 + ) | 9 | 0.11443 | 12 | 0.109375 | 36<br>35<br>34<br>33 | 0.1065<br>0.110<br>0.111<br>0.113 | 12 | 0.104 |
| 11 | 0.1205 | 32<br>31<br>30 | 0.115<br>0.120<br>0.127 | 11 | 0.120 | 0.125 ± 0.005<br>($\frac{1}{8}$) | 8 | 0.12849 | 11 | 0.125 | 31<br>30 | 0.120<br>0.1285 | 10 | 0.128 |
| | | | | | | 0.140 ± 0.005<br>(9.64 — ) | 7 | 0.14428 | 10 | 0.140625 | 29<br>28<br>27 | 0.136<br>0.1405<br>0.144 | 9 | 0.144 |
| | | 24<br>23 | 0.152<br>0.154 | | | 0.155 ± 0.005<br>(5.32 — ) | | | 9 | 0.15625 | 24<br>23<br>22 | 0.151<br>0.153<br>0.155 | 8 | 0.160 |
| | | 18<br>17<br>16 | 0.168<br>0.172<br>0.175 | 8 | 0.165 | 0.170 ± 0.005<br>(11.64 — ) | | | 8 | 0.171875 | 19<br>18<br>17 | 0.166<br>0.1695<br>0.173 | | |
| | | 14<br>13<br>12<br>11 | 0.180<br>0.182<br>0.185<br>0.188 | 7 | 0.180 | 0.185 ± 0.005<br>(3.16 — ) | 5 | 0.18194 | 7 | 0.1875 | 15<br>14<br>13<br>12 | 0.180<br>0.182<br>0.185<br>0.189 | | |
| | | 8<br>7<br>6<br>5 | 0.197<br>0.199<br>0.201<br>0.204 | 6 | 0.203 | 0.200 ± 0.005<br>(13.64 — ) | 4 | 0.20431 | 6 | 0.203125 | 9<br>8<br>7<br>6 | 0.196<br>0.199<br>0.201<br>0.204 | | |
| | | 3<br>2 | 0.212<br>0.219 | 5 | 0.220 | 0.215 ± 0 005<br>(7.32 — ) | | | 5 | 0.21875 | 3 | 0.213 | 5 | 0.212 |
| 4 | 0.225 | 1 | 0.227 | | | 0.230 ± 0.005<br>(15.64 — ) | 3 | 0.22942 | 4 | 0.234375 | 1 | 0.228 | 4 | 0.232 |
| 3 | 0 244 | | | | | 0.250 ± 0.005<br>($\frac{1}{4}$) | | | 3 | 0.250 | | | 3 | 0.252 |

GAGE TABLE USED IN AN AUTOMOBILE FACTORY.

### THE TROUBLES WITH TUBING

Another cause of gage difficulties is in the case of tubing, which is now measused by Birmingham or Stubs gage "BWG," on account of wear on the dies used in the cold-drawing process, a variation will sometimes occur in the outside diameter. When this variation occurs it is in excess of the actual diameter, and ranges from 0.001 inch to 0.010 inch, according to the size of the tube,

the larger variation occurring in the larger sizes. The same applies to inside diameter, which may run proportionally smaller than the actual diameter. Thus the gage or wall may vary from 5 to 10 per cent., according to size. (Orders are therefore accepted subject to this variation, unless otherwise arranged for.)

In brass, copper and kindred metals, a rather peculiar as well as annoying practice exists. Different manufacturers of similar goods do not adhere to similar gages on the same materials. For illustration, a catalog from a copper and brass rolling mills stated the following: "All brass, bronze and german silver in sheets, and all brass, bronze, copper and german silver wire will be measured by Brown & Sharpe gage, unless otherwise ordered.

"Tubing—Unless otherwise ordered, the thickness of *brazed* tubing will be measured by 'Brown & Sharpe's gage,' and that of *seamless* tubing by 'Stubs gage.'

"Sheet Copper—All sheet copper, unless otherwise ordered, is numbered according to 'Stubs gage.' Where practicable, *we prefer that buyers should specify the thickness in parts of an inch or by weight to the square foot.*" In addition to this note is added: "We suggest the adoption of the micrometer caliper to determine the thickness of metal and the diameter of wire in decimal parts of an inch, and the *abolition of all other* gages. This will prevent confusion, * * as *all other gages are defective and cannot be depended upon.*"

The above is quoted direct to show how simple is the language and how primary in all ways instruction given by manufacturers in order to avoid confusion.

### Exceptions That Confuse

The U. T. Hungerford and other large brass and copper companies, marketing a similar line, use the same gage as the above, except on brass and copper wire up to No. 21, inclusive, which is sold by Stubs' or old gage instead of "Brown and Sharpe."

The sum up, or, rather, analyze this chaotic situation regarding wire and sheet-metal gages, it can be divided into five principal causes:

First—Confusion of numerous gage numbers, insufficient information being given, such as name of gage or decimal equuivalent, or the adoption of the "decimal gage."

Second—The "notorious inaccuracy" of gages due to wear from constant use and the impossibility of making a commercial article at a price to make it salable.

Third—Absurdity of the tabulation of some gages, which advances in some cases by the difference of but one or two one-thousandths of an inch (0.001 inch or 0.002 inch), and reads to the millionths decimal place.

Fourth—The wear on dies causing a variation of from 5 to 10 per cent.—0.00625 to 0.0125 on tubing of one-eight inch or 0.125-inch wall.

Fifth—The failure of different manufacturers of similar materials to use the same gage. For instance, a man might look up in one catalog and ask quotations according to explicit instructions given from that firm and expecting that another would use same gage, asking for quotations from them also. He would soon be in a bad mix-up.

Is it any wonder, after carefully considering the above five causes that there is a generally chaotic condition regarding gages?

### A Table That Helps If Gages Are Used

After having this trouble for several years the writer compiled the accompanying table, which has been used with perfect success the past year in the automobile industry.

The adoption of a gage of this kind forestalls a possibility of a misunderstanding from any and all of the above five causes cited. It abolishes some 500 or more different gage numbers, using but 23, which cover same ground as far as is necessary. It might be stated that the Morse gage, when used for twist drills would hardly come under this table, although every mechanic knows what a variation there is even in these drill rods.

Probably there are a great many more reasons that could be given as evidence in favor of such a gage; for instance, in rolling wide sheets the thickness of the metal at the edges of the sheet might be nominal size (gage size ± 0.0), and if the "mikes" were placed on a stamping from the center of the sheet it would be found to be anywhere from 0.001 inch to 0.010 inch over size, this being due to springing of the rolls.

It will be noticed that a table commences 0.005 plus or minus 0.00025 gage, advances by 0.005 inch increments to 0.95 ± 0.003 gage, or practically 1/32 inch, and continues by 0.010 inch increments to 0.95 ± 0.003 gage, or practically 3/32 inch. From 0.095 ± 0.003 gage to 0.250 ± 0.005 gage, or ¼ inch, the increment of advance is 0.015 inch, or approximately 1/64 inch, except the last one, which is 0.020. The limit tolerance increases proportionally with the gage varying from 5 per cent. in 0.005 ± 0.00025 inch gage to 2 per cent. in 0.250 ± 0.05 gage, which is well within the limits of commercially practical production.

Further instances are probably unnecessary and it would behoove some association, such as the Association of Licensed Automobile Manufacturers or the American Society of Mechanical Engineers, to shed some light on the situation, being of as much importance as machine-screw and castle-nut standards to the automobile industry at present.

# Locating Oblique Holes by the Button Method

By J. A. Pander

Recently I had a job to bore oblique holes in a drill jig like the sketch. Three surfaces *m*, *n*, *o*, and bottom face were planed accurately. The angle $\theta$ between holes *P* and *Q*, and dimensions *a* and *d* were given.

The job being an accurate one, I clamped down three buttons to a universal milling-machine table, so that angle *A B C* was equal to $\theta$. Of course, it is an easy thing to make this triangle of buttons; referring to the sketch, if one side *A B* is assumed,

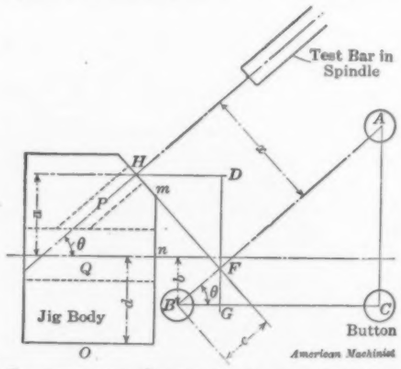
$$B\,C = A\,B\ cos.\ \theta,$$

and

$$A\,C = A\,B\ sin.\ \theta.$$

The triangle may be laid out at any convenient size.

Next, I put the work on the table and, by means of a test indicator, I brought the line *B C* and side face *O* of work parallel to machine spindle and clamped the work. Then, I inserted a test bar in spindle and clamped a block on the face




Getting the Angle from the Buttons

*O;* measured the distance *d*, moving the table, and bored the hole *Q*.

After this, I turned the table through the angle $\theta$, again using indicator to insure accuracy by touching buttons *A* and *B* with it. I then put the test bar in the spindle hole again and moved the table until the micrometer measure between button *A* and the test bar came to *x*. I figured out *x* as follows. (See sketch):

$$x = H\,F = F\,D \times sec.\ \theta,$$

$$F\,D = a + b - F\,G$$

and

$$F\,G = c \times sin.\ \theta.$$

I measured *c* with micrometer. We then have.

$$x = (a + b - c\ sin.\ \theta)\ sec.\ \theta.$$

In this way I got the spindle to hole *P* and bored it out.

In many other cases of oblique holes I have used this method and could figure *x* in about the same way. I think it is convenient to make buttons and test arbor the same diameter, and ½ inch is about the right size.

# Machine Blowing of Window Glass

By E. Justus Miller

*Modern machines which are now taking the place of the old hand process of making window glass.*

*Molten glass put into white hot clay pots and drawn and blown into cylinders thirty feet long by hydraulically operated air blowpipes. Cylinders slit and flattened into sheets. Extreme care required to produce clear glass.*

Few people looking through their windows at the daily events taking place on the outside ever stop to wonder how the window glass itself was made. Even if they should try to find out, they would seek a long time before learning that it was made other than by hand, by the methods of 50 or 100 years ago, and as it still is being made today. Yet the chances are about one in three that that pane of glass is machine made, as about one-third of the glass in the United States is machine made by the American Window Glass and Machine Company, of Pittsburg, Penn. In a few years not a pane of glass will be made by hand; as the glass industry, from being one of the most backward, is becoming one of the most progressive, and the possibilities for the scientific man and inventive genius are great, as the field is practically new and has great opportunities for development.

A few years ago glass manufacturers sought and paid big salaries to "master teazers" (men who superintend melting tank and mixture of materials) who were the alchemists in glass and who, three or four times a day, threw into the tank a mysterious secret powder that was supposed to purify the glass. Now the chemist has applied pyrometers to keep the temperature even and pays attention to the purity of the materials, so the old master teazer has lost his mysterious importance.

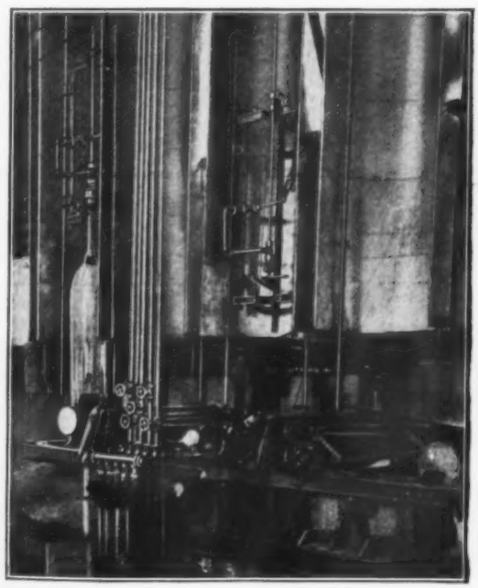


FIG. 1. FIRST STAGE IN MACHINE BLOWING A GLASS CYLINDER OR "ROLLER." POT-CYLINDER MACHINE IN FOREGROUND

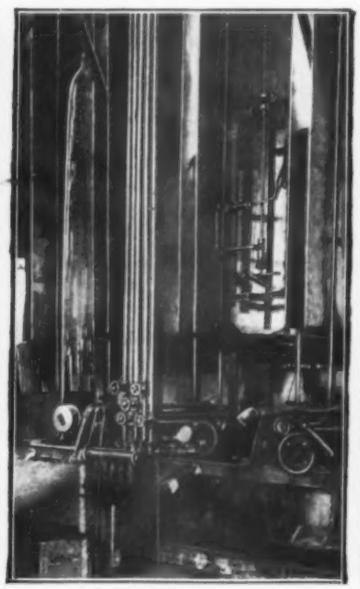


FIG. 2. NEARING COMPLETION OF GLASS ROLLER. SHOWS CONTROL VALVES IN FRONT

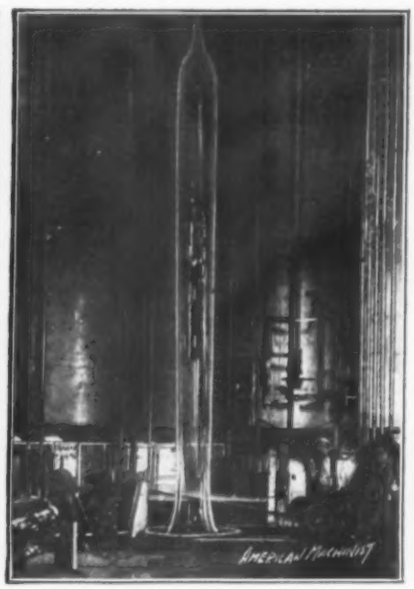


FIG. 3. GLASS ROLLER COMPLETELY BLOWN, READY FOR SEVERING

### MELTING RAW MATERIALS. LADLING

Glass is melted and purified for working in a large tank, averaging about 20x60 feet, and built by fireclay blocks a foot thick and with a roof of silica brick. The general construction of the tank is similar to a regenerative open-hearth steel furnace, the fuel most commonly used being natural gas, and the direction of the flame being periodically reversed, so as to recover the stack heat in firebrick checker work, and also to prevent burning out the passages.

Raw materials are generally mixed by hand, but a few of the more progressive plants are now employing machinery to mix and deliver the batch to the tank somewhat as an automatic stoker feeds a boiler, care being taken that it is thoroughly mixed and placed in the tank with as little disturbance as possible, as if thrown in carelessly, the flying dust of the flux would assail the walls and roof of the tank.

The ladle used in dipping the glass from the tank is made of a hemisphere of pressed steel, 20 to 25 inches in diameter, one-fourth of an inch thick; to which is attached a stout pipe handle about 14 feet in length, and a side handle projecting from this at right angles, for dumping. The ladle is supported from a crane in a loose collar, which allows movement in all directions. The ladle is made hemispherical because other shapes were found to produce unequal cooling of the mass, showing what trivial defects become serious matters in glass manufacture.

At a signal from the machine operator, the ladler and his assistant approach the tank with the ladle bottom side up. When the ladle is a few feet from the tank the door is raised and the ladler shoves the ladle totally inside the tank with the rim of the ladle, now upside down, just over the surface of the glass. Then, revolving ladle with the main handle as the axis, the ladle is filled by cutting (so to speak) a hemisphere of glass out of the tank with the least possible disturbance. If this part of the operation is done carelessly, or with a dipping motion that allows the glass to flow into the ladle, the tendency is to form air bubbles and unequal cooling strains, and if persisted in, will mess the glass up to an unworkable state altogeth-

er. If air bubbles are formed in the tank, they require hours and days to burn out, and if formed in a ladle of glass, a bubble as big as a pin head will draw the length of 30-foot "roller" (as the cylinder of glass is called), and be clearly visible. This being a defect, many bubbles will make the roller worthless altogether.

To return to our ladler; as the semi-revolution is about completed, the ladler lifts the ladle out of the body of glass and tries to do so in such a way that the drip that forms on ladle edge last leaving the surface of glass, is cut off. This can be done so no drip is left at all.

Removing the glass from the ladle to the machine is the most important part of the ladling and is accomplished in one of two generally approved methods. The idea in both is to remove it with as little disturbance as possible and make the necessary disturbance equal in all directions. The more generally used method is to start to pour on one side of the pot and, by moving the ladle over the top of pot, the glass is placed in pot somewhat as a pie is put on a plate by slipping the pan from under the pie. This method causes greater unevenness of flow than dropping the mass in the center, but eliminates liability to air bubbles and brings the drip to the edge of pot where it is practically harmless.

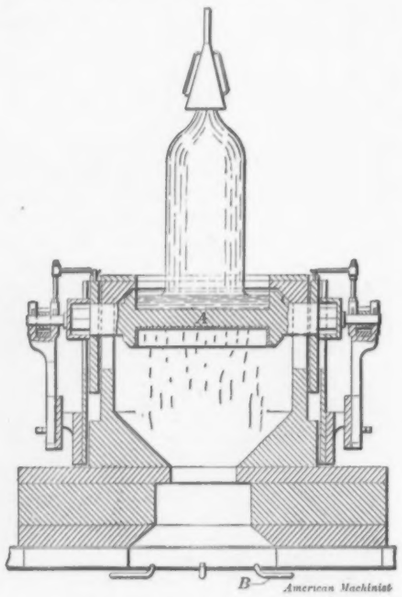



FIG. 4. REVERSING POT-GLASS MACHINE FOR CONTINUOUS OPERATION

### GLASS-BLOWING MACHINES

The principal methods of manufacturing window glass by machinery are the cylinder-pot-drawing machine, drawing cylinders directly from tank, and drawing the glass in a continuous sheet directly from tank. Of these, the sheet machine, although unperfected, is the most ideal as it eliminates the ladling and flattening necessary by the first method, thereby producing a pane of glass of unequaled brilliancy. The cylinder machine drawing direct from tank is the ideal cylinder machine, as it eliminates the ladling process, but so far has not been perfected so as to compete with the pot machine. The cylinder-pot-drawing machine is the one drawing glass commercially today and is described in general as follows:

As inferred by the name, the pot forms the principal part of the machine. It is a shallow pot about 4 to 6 inches deep and 36 to 40 inches in diameter, having a uniform thickness of 1½ to 2 inches. It is made of a specially high-grade fire clay imported from Germany, the clay going through months of preparation before the pot is ready to put in machine. Some of these operations are grinding, ageing for several months and tramping with bare feet. This latter process seems rather mediæval at first glance, but it is the only one possible to accomplish the purpose; that of removing air bubbles and unground pieces of clay or stone. During all this period it is kept at a certain degree of moisture by being covered with cloth and sprinkled day and night.

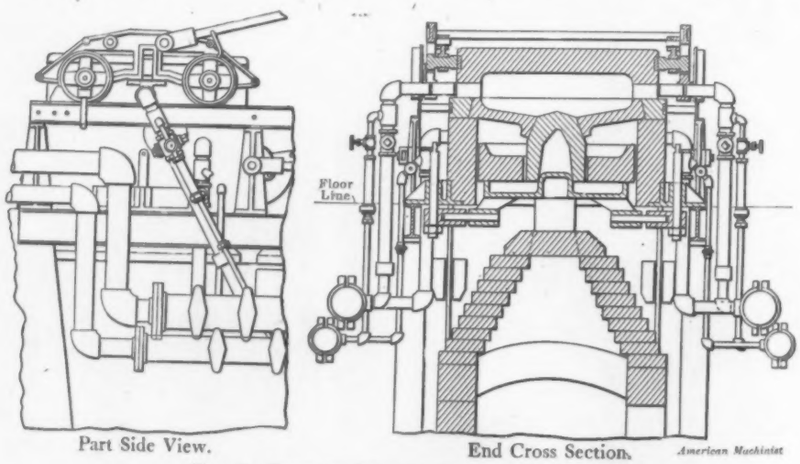



FIG. 5. PART OF DOUBLE POT-GLASS MACHINE

Figs. 4 and 5 show sectional views of two successful pot machines. In Fig. 4 the pot *A* is double, and reversible on trunnions, and the principle of the machine is that while one side is filled with glass and cylinder being drawn, the other side is being cleansed of "bad glass," or undrawn residue, by the action of heat from burners *B*. These burners also are used to keep the pot in a heated condition, which tends to keep the molten glass in upper side of pot at an even temperature. The drawing and cleansing thus being simultaneous, the machine is continuous. These pots must be put into the machine already heated to a white heat, and inserted quickly to prevent sudden cooling and consequent cracking and checking.

Fig. 5 shows a part of the general arrangement and cross-section of the other machine, in which two separate pots are used to a unit. Each machine consists of three component parts—two duplicate furnaces, each containing a pot; and a furnace hood. As shown in sectional view, the pot has a hole in the center which is closed by a movable fire-clay plunger. Beneath the pot, in furnace proper, air-blast gas burners are inserted. The furnace hood consists of a fire-clay covering having telescopic pipe connections for burners, and mounted on a carriage that allows of the hood being moved as a whole from over one pot to over the other. While a cylinder of glass is being drawn from one pot, the bad glass is being melted from the other. The raising and lowering of the plunger closes and opens the bottom of the pot as required.

### THE BLOWPIPE CARRIAGE

Over these machines is placed the structural-steel framework which supports the "ways" for the blowpipe, or drawing carriage. The ways consist of 2-inch cold-rolled steel shaftings, two to each pot of each machine, spaced three feet between centers. Between the shafts and the arms is also a semi-circular galvanized-iron shield, clearly shown in Figs. 1, 2 and 3; the object being to protect the roller from all air drafts while being drawn and cooled. On the ways are the blowpipe carriages, one of which is shown in Fig. 6. The movement of these carriages is controlled by cables from hydraulic cylinders supported on the structural framework in the rear.

The control of all the carriages and the air supplied to blowpipes is concentrated at the operator's stand, which is located about 10 feet in front of, and central with the machines, as shown in Figs. 1 and 2. Fig. 8 shows a diagram of the air and water system for the blowpipe carriage. The water is delivered to the main line at 150-pounds pressure, maintained constant by an accumulator which

automatically starts and stops the pump as needed. This water operates the plunger, the stroke of which is half the travel of the blowpipe carriage. The plunger is connected to the carriage by a ½-inch steel cable running over pulleys on top of structural framework.

Air is supplied to the main air line at 6 to 7 ounces per square inch, by a steel pressure blower, and this pressure is maintained constant by an aërometer

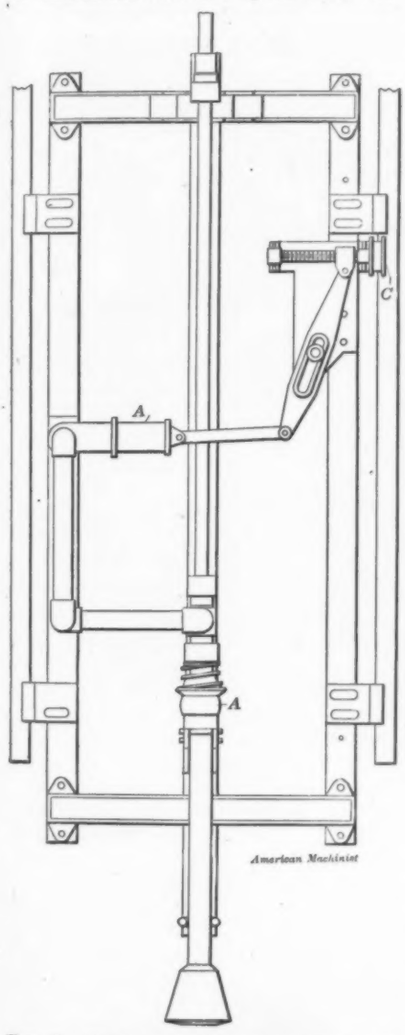



FIG. 6. DETAILS OF DRAWING CARRIAGE WITH AUTOMATIC AIR-CONTROL VALVE

whose action is automatic on the pressure blower, increasing or decreasing its capacity as needed in the main line. From the main line are taken branches for each blowpipe carriage; the pipe coming straight up from the floor with valve at operator's stand, and from floor going to top of structural framework, where it connects to a 4-inch pipe that sticks out of roof of building about 20 feet. This 4-inch pipe acts as the covering or telescopic connection for air pipe supported on blowpipe carriage, and also gives additional reservoir capacity for maintaining uniform air pressure. Each telescopic air pipe terminates on the carriage in a socket fitting a ball on the blowpipe, all of which are thus interchangeable, and making an air-tight and easily detached joint between the two.

### THE BLOWING PROCESS

At a signal from the operator, the ladler and helper start the ladling process described above; at the same time the blowpipe man takes blowpipe from heating furnace where a number of them are being heated to a cherry red on the lower half of the Norway iron head. Placing blowpipe in a saddle, he cleans the head of all scale and glass with a rough file and makes sure that air hole is clean. Having done this, he brings blowpipe to carriage and attaches it to

FIG. 7. TWO GLASS "ROLLERS"

the air pipe. While this latter is being done, the furnace-hood man removes hood from pot in which ladler is to pour glass.

The pot being filled, the operator then lowers the carriage until the heated head of blowpipe enters molten glass about an inch, allowing this to stand a few seconds for the glass to adhere. He then very carefully turns on the air until a bubble appears underneath the blowpipe. This latter part of the operation must be very carefully done, lest too much air be turned on, blowing out to one side and making it necessary to dump the whole pot of glass; as once blown out, it is useless to try to form a new bubble. The bubble being formed, the carriage is started slowly upward with air shut off for an instant and then gradually turned on again; and the glass begins to bulge out, forming a neck similar to that of a bottle. When the neck is fully formed, the air valve is left as it is at this point and the speed of drawing slightly increased, averaging about 40 inches per minute, depending upon the quality of the glass, temperature and thickness desired.

From the time the neck is formed until the cylinder is drawn, there must be a gradual and scarcely perceptible increase in the air supply and speed of drawing, on account of the varying condition of the air pressure and temperature of glass. At the start of the cylinder, the entering air strikes the surface of the molten glass and is expanded, thereby increasing the pressure; as the cylinder is drawn, the mouth of blowpipe recedes from the surface of the molten glass and the entering air becomes less and less heated, requiring a greater volume of entering air to maintain the pressure. Also, as the glass in pot is each instant becoming cooler, it is necessary to draw faster in order to keep the thickness of the glass constant.

Air is increased by means of valve *A* on carriage, Fig. 6, which has a long, narrow slot automatically controlled by a piston as carriage moves upward. Motion is communicated to the piston by the

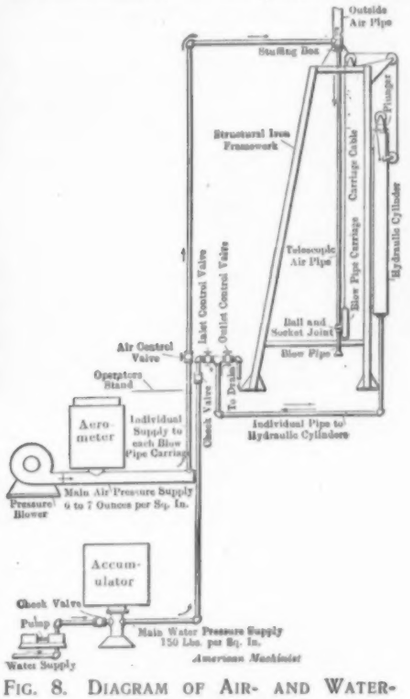



FIG. 8. DIAGRAM OF AIR- AND WATER-CONTROL PIPING

levers and links shown, actuated by a rack. For changing speed of drawing, the best method has been found to be manual; that is, by the operator opening valve to hydraulic cylinders as required, as the ever changing atmospheric conditions forbid any set speed of drawing.

Figs. 1, 2 and 3 show various stages of the cylinder while drawing; the latter one showing cylinder drawn to full length and ready to be severed from pot. This is done by shutting off air supply, causing cylinder to draw in again near pot, and then pressing a sharp-pointed rod, slightly dampened on point, against neck just formed; a crack is started

which, by suddenly increasing drawing speed, is made to extend clear around neck, thus severing cylinder from pot.

Cylinder is now taken down and laid on horses, to be cut in suitable lengths for flattening. Taking down is accomplished with asbestos-covered tongs placed around lower end of cylinder, and carried by a pulley on a rope. The blowpipe swings in a ball-and-socket joint and the next operation is to remove blowpipe from cylinder. This is done with a moistened, sharp-pointed instrument, as for the lower end.

### Capping with an Electric Wire

Immediately upon being laid on horses, the two rounded and rough ends are capped off and the cylinder cut into lengths desired, depending upon the size of sheets into which the glass is to be cut after flattening. This cutting or capping is done by encircling cylinder with a small (about 1/32 in.) iron wire, heated to a dull red by an electric current. The current is then turned off and cutting performed by moistened, pointed rod. These short lengths of cylinder are then placed on other horses, to be cracked open lengthwise. This is done by using a long, heated rod shaped like a knife-edge planimeter, following this with the moistened, sharp-pointed rod.

Being split, cylinders are taken to flattening oven where, after being gradually heated almost to the collapsing point, they are spread out and smoothed by a moistened wooden block on a long handle. After this, they pass through the "lehr," or oven, in which they proceed from a highly heated to a cold condition, so as to temper the glass. This is followed by plunging into an acid batn to clean the surfaces.

The final operation is cutting to the best advantage to avoid defects, the quality of the glass depending upon its relative absence from these. These sheets are placed in boxes according to size and quality, each box containing 50 square feet.

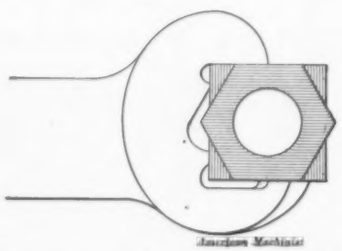
## The Ratchetless Wrench

By John E. Sweet

The history of this wrench is this—I was engaged as draftsman at the Patent Nut and Bolt Company in Birmingham, Eng., and we had commenced the manufacture of finished nuts before the case-hardened ones were in vogue. On these the spanners (the English word for the American wrench) would mar them unless a mechanical fit—and this led to the design given in the illustration. As at that time I had commenced writing for *Engineering* this appeared in that paper on page 112, July 31, 1868, as follows:

"In the use of the ordinary spanner on finished nuts either one or the other of two objections has to be endured. If the spanner is a perfect fit it must be brought to the exact angle at which the nut stands before it can be entered on, and then the least dirt or bruise will make it stick or prevent it from going on altogether. If the spanner is a loose fit all the strain is thrown on the corners of the nut and perfection in workmanship in this case only aggravates the evil.

"The spanner shown above may be a perfect fit, takes a bearing on three sides of either a square or hexagon nut and will enter on freely when brought to any angle within ten degrees of the angle at which the nut may stand. Although the jaws are thick and strong, a nut



"Ratchetless Ratchet Wrench"

standing against a flange can be turned even when there is only room for the corners of the nut to pass. This principle may be carried out in different ways, and even introduced into shifting spanners; but the form here shown has the merit of extreme simplicity and yet should be used for the work for which it is designed—finished nuts—and only by men who, it is hoped will appreciate its advantages, 'finished workmen.'"

## An Improved Protractor

By W. E. Barnard

Fig. 1 shows the tool and Fig. 2 the parts. The improvement consists in the little nurled part *A*, Fig. 1, for moving the arm around the central post. On the other end of *A* is a small pinion also marked *A* in Fig. 2. This engages with the ring gear *B* attached by the two pins shown to the member *C*. The gear is 1¼ diameter and the pinion ¼ inch. The large gear *B* is located central on the base *C* of the protractor and fastened by the two pins which are a drive fit in the gear

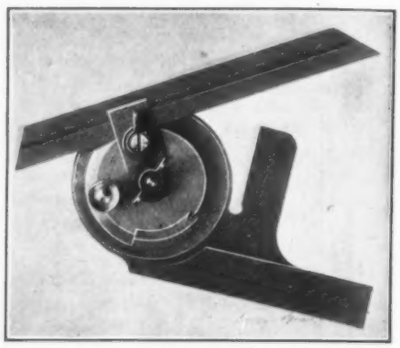


Fig. 1. An Improved Protractor

and a snug fit in the base *C*. The member *D* is recessed to fit over the gear *B*, being sure to have clearance. The center part of *D* is turned to fit inside the gear so that the gear can be located on it and the pinion located in mesh with the gear. After this the hole in the pinion is transferred through the member *D*, and the center of *D* is then reduced in size so that the gear ring *B* will not bind on it when in use. The nurled adjusting nut is pinned to the short shaft to which the pinion is fastened either by brazing or any other suitable means.

The improvement does not interfere with the adjustment of the tool in the old way.

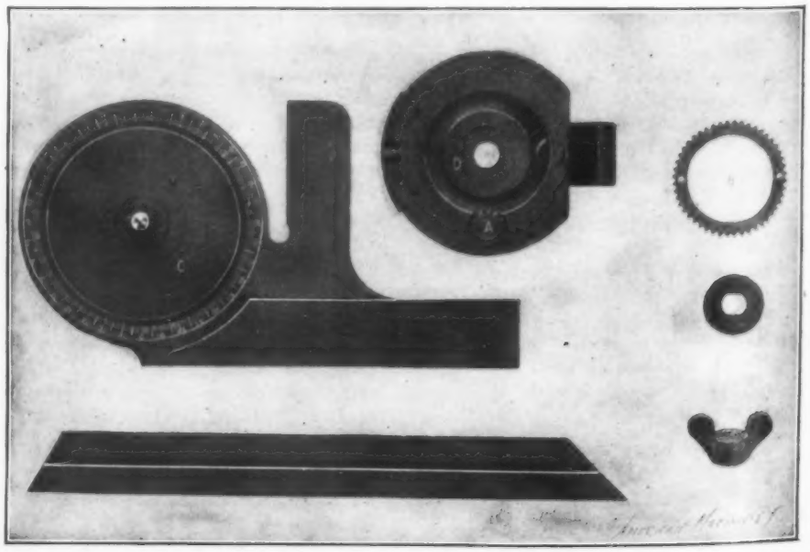


Fig. 2. The Protractor Disassembled

Those who are familiar with the old style of Brown & Sharpe bevel protractor will see that I have applied the vernier attachment for reading in minutes.

I did so by turning the top piece to the diameter of the latest Brown & Sharpe tool, and locating the vernier, which can be bought for a small amount, and with a little trouble will convert the old style protractor into a tool that will compete with the latest.

## A Punch and Die for Battery Tops

By E. M. Erb*

An interesting punch and die are shown in Fig. 1, the work in Fig. 2, while line cut, Fig. 3, makes clear the details.

In the sketch *A* is the blanking die, *B* the blanking punch, *D* the pressure ring,

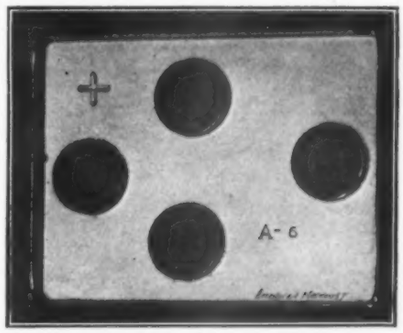



Fig. 2. A Battery Top Produced by Punch and Die Shown in Fig. 1

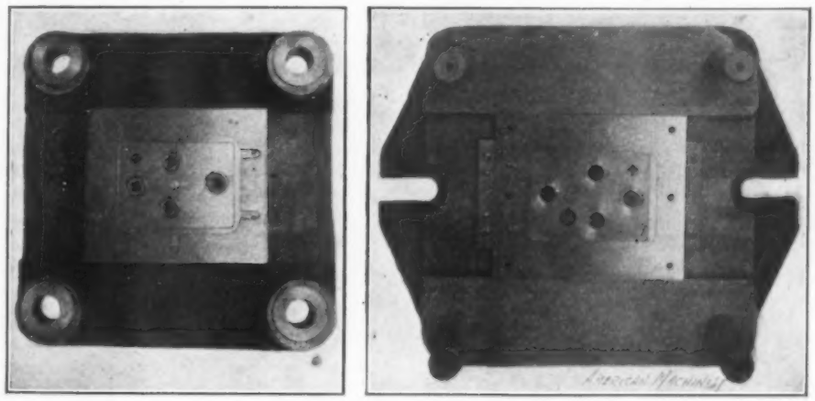


Fig. 1. A Punch and Die for Battery Tops

acted upon by the rubber spring barrel through plate *E* and pins *F*. The knockout pad *G* is operated by four heavy springs, and limited in downward movement by a central screw as shown. Pad *H* is a snug fit in the drawing die, and holds the four combined piercing and eyelet drawing punches *I*. The drawing punch *C* carries the sleeves *J*, which are backed up by the springs *K*, sufficiently heavy to resist the pressure of piercing the holes, which is the first step in drawing up the eyelets. These punches are well sheared to reduce the pressure to a minimum. As the press slide continues to descend the sleeves act as pressure rings to hold the metal while the eyelet is being drawn. The scrap punchings drop out through the inclined slots in the upper spring-barrel plate *E*.

The following method was used to insure the alinement of the four drawing and piercing punches in upper die plate with the corresponding hole in the drawing punch.

The drawing punch and die were hardened and finished, the holes in drawing punch about 0.007 inch small to allow for grinding. Trial draws were made and blank shape corrected until an evenly drawn shell resulted, which was left on the punch. The pad for holding

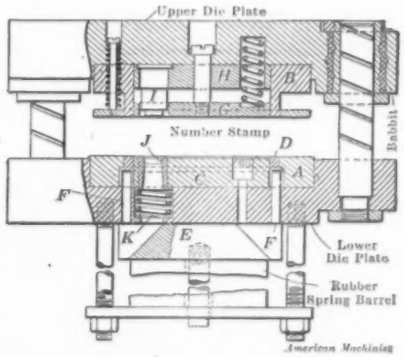



Fig. 3. Details of Punch and Die for Battery Tops

the punches was then set in place in the drawing die, the knockout pad inserted and the drawing punch with shell still on it pressed into place, taking pains to have the bottom surface of drawing punch and back of drawing die parallel. The holes in the drawing punch were transferred through knockout and punch-holder pad, using the drawing punch as a jig. The entire assemblage was then swung on a trued face plate and all holes ground out to size, through drawing punch, knockout pad and punch-holder pad. A master plate was used for correctly locating the holes, each location being accurately determined with a very sensitive test indicator.

The accuracy of this method is proved in the drawn eyelet, there being no appreciable difference in the hight of draw around the entire circumference.

As shown, the hardened, ground and lapped pillars are let into holes (bored at one setting in the miller) in the bottom die plate. The bushings in the upper plate are of very close-grained cast iron, and are a rather snug sliding fit on the pillars. These bushings are babbitted into cored holes in the upper plate, the completed die being set up with a shell in place, on parallels, while being babbitted.

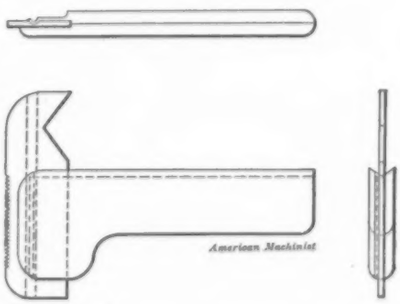
The shell produced in this die was formerly made in six separate operations, blanking, drawing, piercing eyelet holes, drawing eyelets, stamping and embossing. Aside from the saving in operation costs absolute interchangeability is assured and wasters practically eliminated.

The stock used is cold-rolled steel, 0.025 inch thick, dull nickled on both sides.;

## A Twist Drill Grinding Gage

By W. T. Gray

The gage is made of three pieces, two of which are riveted together and form the stock. The stock is machined at its upper end, prior to the riveting, to form a slide for the actual angle gage; it also




A Twist-drill Grinding Gage

has a V machined along its straight side. The drill to be tested is laid in this V and the angle gage is then adjusted until its two angular edges make contact with the cutting edges of the drill, as it lies in the stock, then the drill is rotated a half turn; if now, the two cutting edges make contact with the angular edges of the gage it will at once be obvious that its two cutting edges are of the same length as each other, and that the angle at which they are inclined to the axis of the drill is the same for one edge as for the other. It follows from this, that the point of the drill will be central with its axis.

*E. M. Erb Manufacturing Company, Jersey City, N. J.

## Special Tools For Gas Engine Work

In Davenport, Iowa, Schmidt Brothers build a small gasolene engine that is something of a novelty in a number of ways, and are using a number of very interesting methods in their shops.

In Fig. 1 is shown a special lathe fixture and tools used in turning pistons. For photographing, the swivel tool block *A* is turned partly around in order to more clearly show the construction. In use it is turned to position, the pin *B* dropping into a locating bushing on the *left* side of the slide, and the bolt *C* tightened, which holds the fixture rigidly in position.

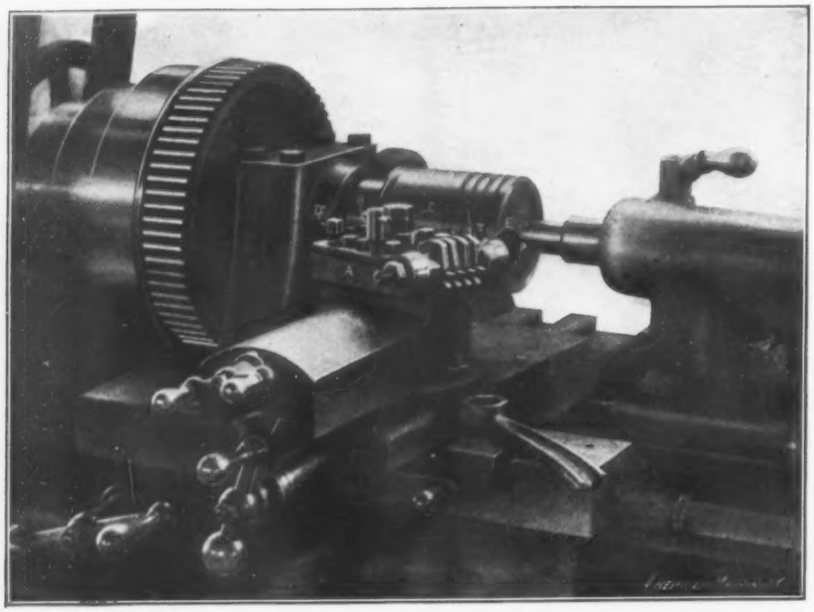


FIG. 1. SPECIAL LATHE FIXTURE AND TOOLS USED IN TURNING PISTONS

The set screw *D* holds a turning tool with which the piston is rough and finish turned; the set screw is then released and the tool slipped back into the body of the fixture, and the gang of roughing tools (not seen in the cut) are brought forward and the grooves roughed.

The fixture is then turned half way around, when the pin *B* drops into a locating bushing on the *right* side of the slide. The formed tool *E* is then brought into action and the grooves finished; thus completing the turning and grooving at one setting, with the assurance that the grooves will be properly spaced and of the right width.

### AIR-COOLED CYLINDERS CAST WITHOUT FINS

In making the air-cooled cylinders for these engines some very interesting and unusual methods are employed; the outer part being cast solid and the grooves and fins machined in afterward.

By a special foundry operation the *bore* of the cylinder is made very dense and fine grained, while the outside which forms the fins is very porous, thus giving a very fine wearing surface in the cylinder, and an unusually large radiating surface, owing to the porous structure of the fins.

The method of machining these cylinders is shown in Fig. 2. The machine used was designed by Mr. Schmidt, and built by the Moline Tool Company, of Moline, Ill.

After bolting the cylinder to the faceplate of the machine where it is located by suitable stops, it is turned all over with a tool in the tool post *A*. The roughing bar *B* is then put through and is followed by the second bar *C*, which also carries the tool *D* that forms the seat for the cylinder head.

### TURNING THE FINS

With the bar *C* still in position in order to support the cylinder, the gang tools in the slide *E* are brought into use and the fins turned, leaving the walls of the cylinder about ½ inch in thickness. The reamers *F* and *G* are then put through, which finishes the bore of the cylinder, and the operations on this machine.

By referring to the halftone, it will be seen that each bar in the turret is threaded on the end. The object of this may not be readily seen without explanation.

A supporting bar extending through and fitting the hollow spindle of the machine is screwed onto the bars by means of a handwheel at the end of the machine. This gives a very rigid support to the bars and permitting cuts that would otherwise be impossible.

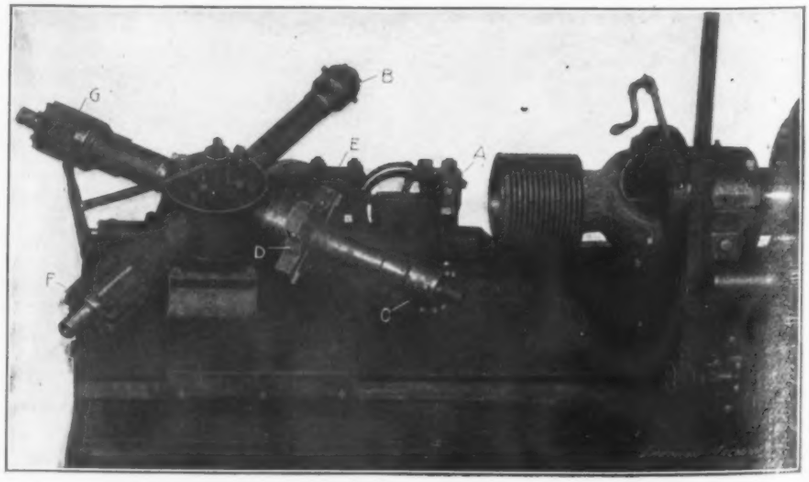



FIG. 2. A SPECIAL LATHE FOR BORING CYLINDERS AND TURNING AIR-COOLING RIBS

## Some More Art Blacksmithing

BY E. A. DIXIE

I spent the other afternoon at the forge of James Cran, the artsmith, of Plainfield, N. J. It is now only a little over two years since he first started making art objects in iron and as he has never seen any of the other artsmiths at work he has had to work out all his own short cuts.

In the two years which have elapsed since I was in his shop his work has improved much from an artistic point of view. It has entirely lost the slight stiffness which marked his early work and he has widened his field from roses until now he forges a large variety of flowers and insects besides making bases and backgrounds of hand-hammered sheet iron. The manipulation of the work has also changed considerably in the past two years. As an example he made me a rose because I am familiar with his former method, which I described on page 10, Volume 32, Part 1.

As a beginning for the new rose a core is made, as shown at *A*, Fig. 1. It is simply a solid piece of iron to prevent the rose from crushing while being held and worked and it takes the place of several of the small petals formerly used. The petals used to be hammered into shape, using the hammer and anvil only, but now the block *B*, Fig. 1, with hemispherical depressions of varying sizes, used in conjunction with a ball-peened hammer, cuts out a lot of the work of shaping the petals.

The first three petals are arranged around the core *A*, as shown at *C*, Fig. 1, and after welding their stems together and to the stem of the core another set of three petals is welded on in the same way. The ring *E*, Fig. 1, is then driven over the petals, as shown at *F*. Four large petals are now placed over the piece shown at *F*, and the stems again welded. A final set of four petals finishes the job. While the job is still hot the two outer rows of petals are bent back and the piece *E* is driven off, its object, keeping the inner petals from crushing, having been accomplished. The petals are then shaped up with plyers, as described in the former article.

Figs. 2 to 5 show samples of work done recently. Fig. 2 is an ash tray, the spray of roses is tied to the large leaf by an iron ribbon.

The thistle, Fig. 3, is 15 inches high and is made of about 25 different pieces of iron welded together. This is exclu-

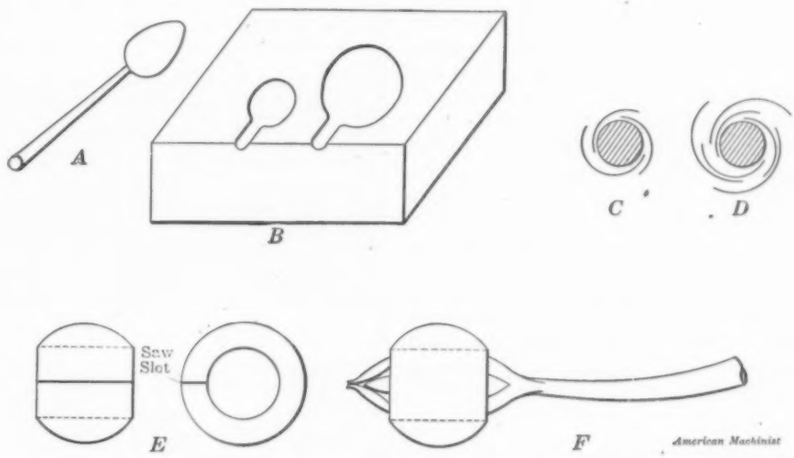
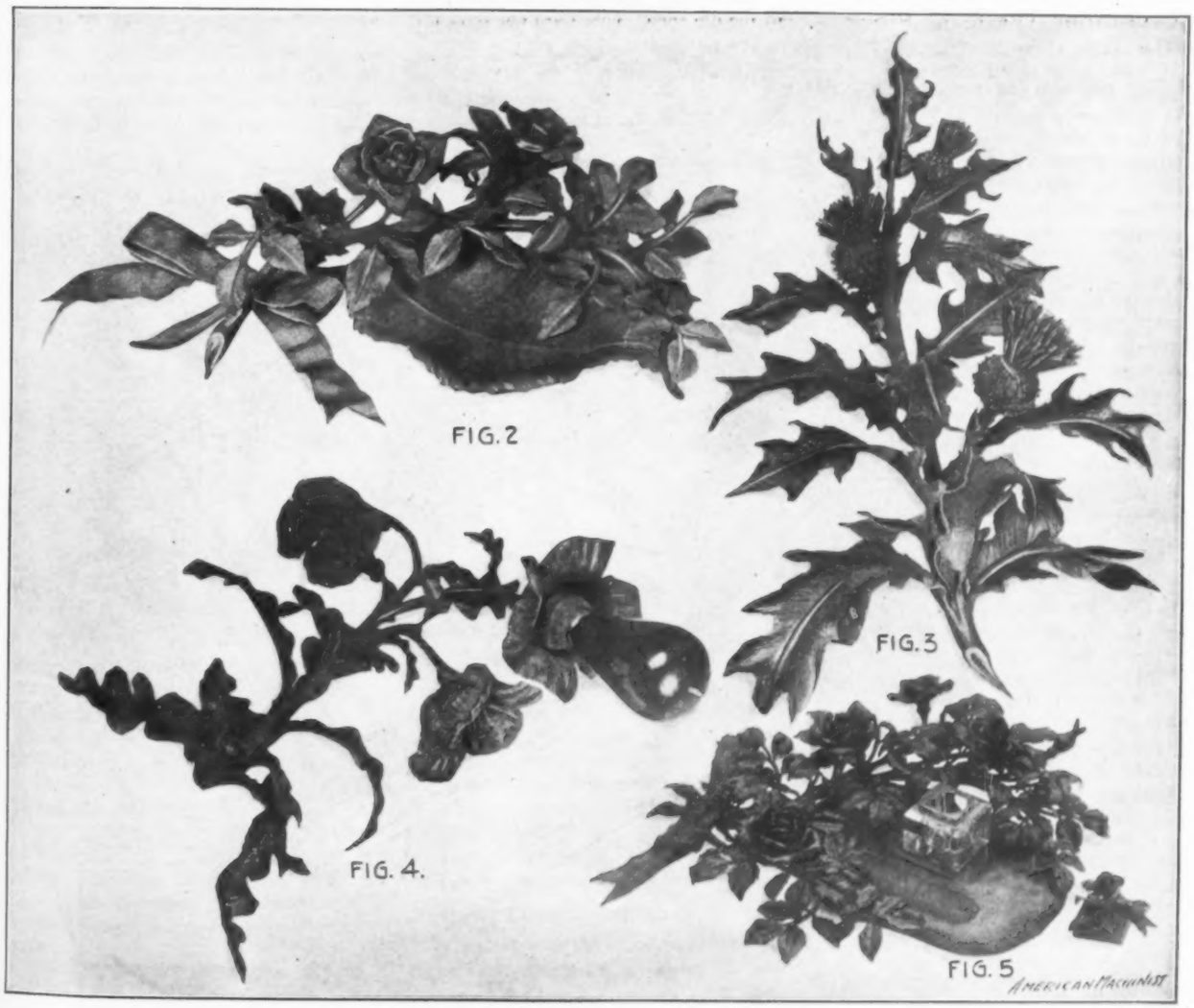



FIG. 1. NEW TOOLS AND METHODS USED




ART BLACKSMITH WORK

sive of the wires used in the flowers. As everyone knows the stalk of a thistle is approximately round and covered with thorns. The iron stem for the thistle was first forged square, then hacked on all the corners to form thorns. It was then twisted hot, which made it aproximately round and caused the thorns to stick out all around. The thistle weighs about 6 pounds and took about 20 hours to finish. Fig. 4 is made of about 15 pieces, exclusive of the stamens at the poppies, which are little crutch-shaped pieces of iron, each forged separately. This piece took about nine hours to forge. Fig. 5 contains 250 separate pieces. It measures 16x14 inches. The base is made of 1/16-inch sheet iron hammered to shape. The depression for the pens is hammered and the square depression for the glass ink bottle is also hammered to shape. It is about ⅜ inch deep and the bottom is left in. This piece took about 60 hours to finish.

## A Blanking and Piercing Die without Waste of Stock

By Charles Weslow

This die cuts out two binding bands as shown in Fig. 1, with one stroke of the press, and is virtually a small pair of vertical shears. The dimensions of the bands are given at *J*, Fig. 1. The material is stove-pipe iron. *A* is the usual die shoe, cast solid. The ribs *B* are machined to receive the shear holder block *C*, see Fig. 2, which fits snug, and is fastened by screws underneath. In Fig. 2 can be seen the way the shears *D* are held by the screws *S*. They stand on an angle of 3 degrees, allowing the alternate blanks to easily "fall in." Shims are used as the shears wear.

*E* are side gages ⅜ inch thick, cold rolled, and about 18 inches long, fastened on the die end by the screws *G;* at the outer end they are supported by props on the press table. *F* is ⅛ inch thick, cold-rolled supports for the stock, acting also as trusses on the side gages *E*. Three of these are used and are riveted to the gages. The tops are flush with the top of the dies and in the first stroke the forward edge of the stock is held against the temporary stops *Z*, locating the two first piercings properly. These temporary stops then act as props for the stock to elevate it high enough so that the forward edge of the stock easily passes over the cutting edge *H* or shear.

In the second, third and fourth strokes the blanks slide out of the die as at *I* (the press being set upon an angle). After the fourth stroke they also slide out or down the side as at *J*, each alternate blank being chopped off the block *K*, which is also a part of one piercing die. *L* and *M* are then the positive stops.

The projecting part *N* of the hardened block *O* acts as a guide or brace for the chopping punch *P*. After the fifth stroke the press runs continuously at 90 revolutions and the stock is easily fed in by hand on a press with 2½ inches stroke in that time.

*Q* is a stripper for the piercing or slitting punches, the nearest one removed to show the dies, which are of sectional

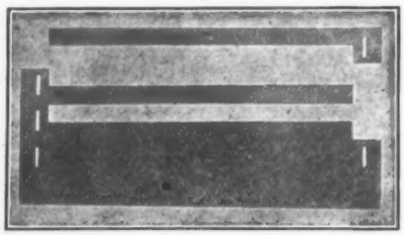


Fig. 3. The Stock and the Work

type. These strippers are inserted in grooves in the side gages *E* to have them as low as possible and out of the way of the larger part of the slitting punches *V*.

Guide posts or pilot pins, one inch in diameter, are provided at the outer end of the die shoe. These are not shown.

The punch *T* is in one piece, except for the piece *U* which is dovetailed to the punch *T* and extends up only as far as the bottom of the cast-iron punch holders, while the punch *T* is inserted in a groove in the punch holder and held by horizontal pins.

The shear is on the punch, the lowest point being at one side, which was found to be most satisfactory.

The halftone, Fig. 3, shows the stock after the fourth stroke, one blank being ready to be chopped off at the block *K*. I designed and built this die for the Western Wire Goods and Stamping Company, Buffalo, N. Y.

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Complete particulars are now announced by L. P. Breckenridge, professor of mechanical engineering at Sheffield Scientific School, New Haven, Conn., of the new Mason Laboratory of Mechanical Engineering, the gift of which has been previously reported in these columns. It will be remembered that the gift for this laboratory included $200,000 for the building and its equipment and $50,000 for its endowment, all of which was presented by George Grant Mason and William Smith Mason, both of the class of 1888.

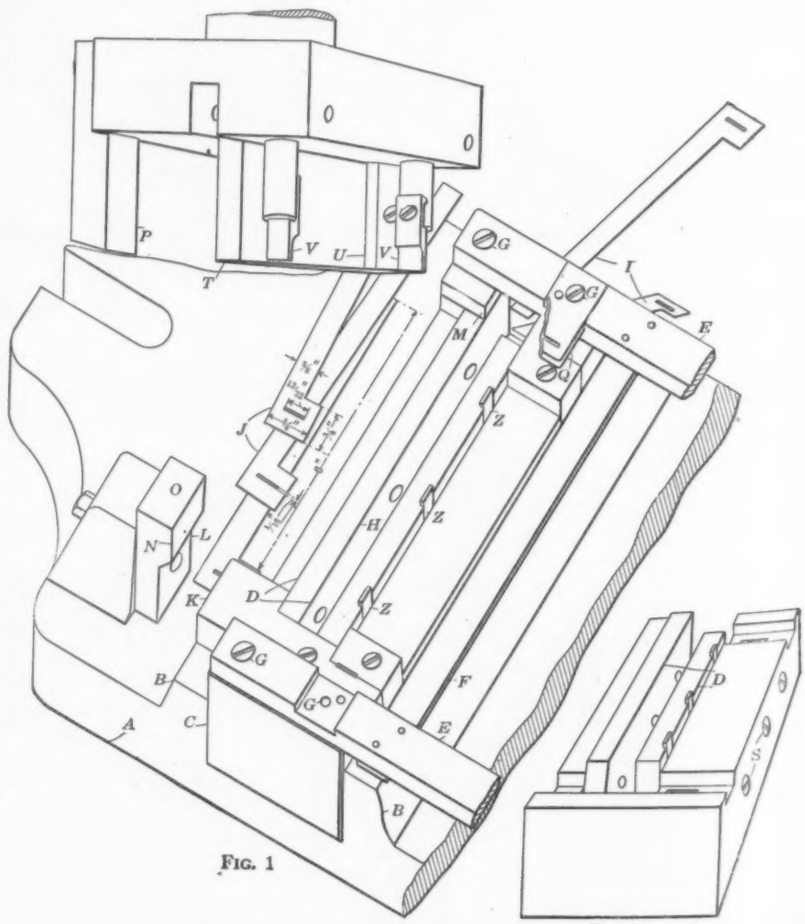



Fig. 1

Fig. 2
*American Machinist*

The Die

# Letters from Practical Men

Concerning the details of making things in machine shops, from the first sketch to the shipping room. A letter good enough to print will be paid for. The value is in the idea—not the length of the letter

## Adjustable Boring Bar Cutter

The adjustable cutter, one end of which is shown in the line cut, Fig. 1, was designed for boring the crank-shaft bearing holes in automobile crank cases where a rigid inspection demanded no variation in size. By the use of these cutters our former trouble in maintaining size with inserted-blade cutters has been eliminated and while these tools work particularly well in aluminum, we are using them with good success in bronze and cast steel.

The body is made of chrome-nickel steel and is turned, threaded and slotted on both ends as shown at *A*. The blade is of high-speed steel, fitted to the slot and the dimension *C*, and is provided with an elongated clearance hole for the clamping screw.

When inserting new blades, the adjusting collar and nut, detailed in Figs. 2 and 3, are run back and the blade inserted with the back toward the head of the clamping screw as shown. Sliding collar *D* supports the blade at *e*, takes the thrust of the adjusting nuts and adds to the rigidity of the whole.

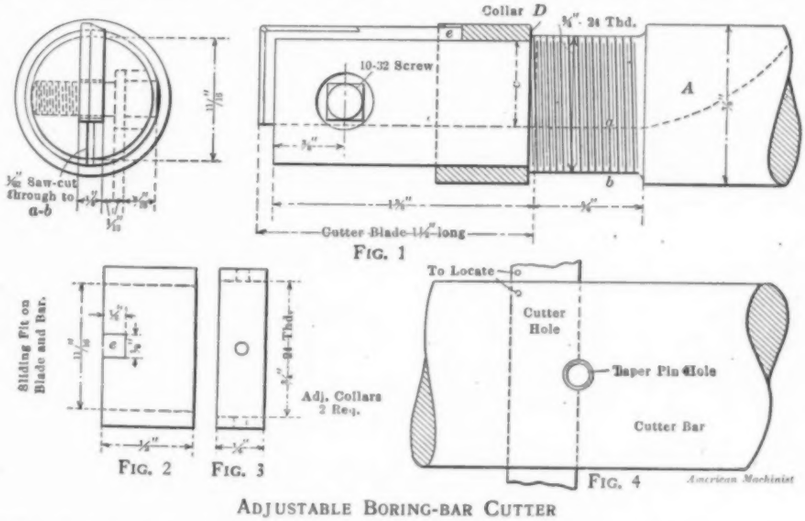



FIG. 1 FIG. 2 FIG. 3 FIG. 4

ADJUSTABLE BORING-BAR CUTTER

After both ends are assembled, the cutter is placed in the boring bar, the latter is swung in an engine lathe and the blades adjusted central by bringing each in turn in contact with a lathe tool held in the tool-post, after which they are turned, allowance being made for grinding, which operation is performed with an electric center grinder held in the tool post.

The grinding operation just described is only necessary when inserting new blades and could be done as well in the boring mill. The blades are honed when dull and subsequent adjustments are made by measuring the blades and adjusting each one-half the required amount.

The cutters are held in the bar by a taper pin as in Fig. 4 and are removed after each operation, so that care must be taken to see that cutters and pin holes are clean.

In operation we rough out the holes with the same type of cutter, the largest holes being 9 inches in diameter, using a 3-inch boring bar. These cutters have been in constant use for 18 months and have given perfect satisfaction, combining low first cost, constant accuracy, and ease of adjustment, in addition to boring a round, smooth hole.

South Euclid, O. PAUL CAMPBELL.

## Fallacy of the Selected Group

Technical schools make much of the records of their men as shown by their employment after graduation. Very naturally a school is judged by its product. Since no one outside the school knows what its raw material is, there is a very natural tendency to select this material with the greatest care so that there may be the least possible difficulty of producing the finest product. The result is that technical schools have become great winnowing machines as well as educational institutions.

This tendency is shared by every educational unit except the kindergarten, and even there the tendency is to locate the schools where the most desirable children are to be had, rather than where the mothers most need to have their children cared for.

Will this tendency also be shared by trade schools?

It will be unfortunate if it is but if it is not what will be the deterrent force? Trade schools will be judged by their output in the way of mechanics. The temptation will be to admit only such boys as show great aptitude and hence a selected group. The result will be that only the finest material will be worked over and that the trade school will in turn become a seive through which only certain selected specimens are allowed to pass.

What is the objection? This, 90 per cent. of the world's population is not of this selected class. That this 90 per cent. may well contain today, as it has contained in the years gone by, many men whose native ability will in later life assert itself, which in turn is a strong indication that this 90 per cent. also contains many men whose brains are naturally sluggish but who, under proper treatment, would prove worth all the work and energy that it would take to educate them.

Then once more the tendency has been to offer the most education to the man who needs it least. The college graduate is a man who would have arrived at that state of education any way. Success in life has little to do with a diploma. Those who drop by the wayside are the ones who have the most need of education. The trade school should offer a helping hand, not to the brightest and smartest, who will make foremen and superintendents regardless of education, but to the boy to whom a steady job at $3 a day looks large, to the boy whose ultimate aim and highest possibility is a job as a working mechanic.

These are the men that we need, not a lot of men whose ambitions and abilities run so much higher.

Can the trade schools fly close enough to the ground to deal with the "great unwashed" rather than with the selected group?

Fitchburg, Mass. CON. WISE.

## Casting Ends and a Shaft into Pipes for Conveyer Belt Rollers

We got an order for quite a number of conveyer-belt rollers for a grain elevator and since they are not subjected to a very heavy strain and do not run very fast, it was thought that wrought-iron pipe might be used, if an easy way could be found for placing the shaft central in the pipe.

After a little experimenting it was decided to make the rollers as in Fig. 1, which is a cross-sectional view of the finished roller.

Fig. 2 shows the pattern, which was made in halves, and pinned together, the large part being the exact size of the pipe; the ends being 1/64 larger than 1⅛ inches, and the bosses were made long enough to permit of facing off.

The wrought-iron pipes were cut the proper length and two holes drilled at each end, after which they were sent to the molding shop, where they were heated to insure their being free from moisture.

The shafts were cut off, and a coarse right- and left-hand thread turned on each of them the proper distance apart, after which the threaded part was tinned. These shafts were centered in the pipe, as shown in Fig. 3. The wooden block *A* was turned with a projection to fit the inside of the pipe, and had a hole bored in the center for the shaft, deep enough to allow it to extend the proper distance beyond the end of the pipe. At the upper end, while the sand is being rammed in, the shaft is kept central by means of piece *B*, which is shown in position on top of the pipe and also in Fig. 4. When the pipe has been nearly filled with sand, piece *B* is removed and the round piece *C*, Fig. 5, is slipped over the shaft and tapped down into the pipe until it is flush with the top of the pipe, then the stick shown in Fig. 6 is put down through the holes in piece *C*, and pressed into the sand until the pin strikes the top of the pipe. The stick and piece *C* are then removed and dry-sand cores from the core box, shown in Fig. 7, are placed in the prints made by the stick, with their tops flush with the top of pipe. These dry-sand cores are for holes to clean the sand out of the pipe after casting.

The pipe and shaft are now placed in the mold which has been formed by the pattern in Fig. 2, each end of the mold being gated with one gate on the joint and a riser on the top.

After being cast, the sand was cleaned out of the inside and the ends of the pipe peened over against the cast iron. The rollers were then put into the latne and the turning done on each end. They were next put into the grinder and the surface of the pipe ground smooth. All that remained was to paint the part of each end that was not turned, and the job was done. We were well pleased in every way with the result, as it gave us a good-looking, strong and serviceable roller at comparatively small cost.

Galt, Ont. J. A. McEWAN.

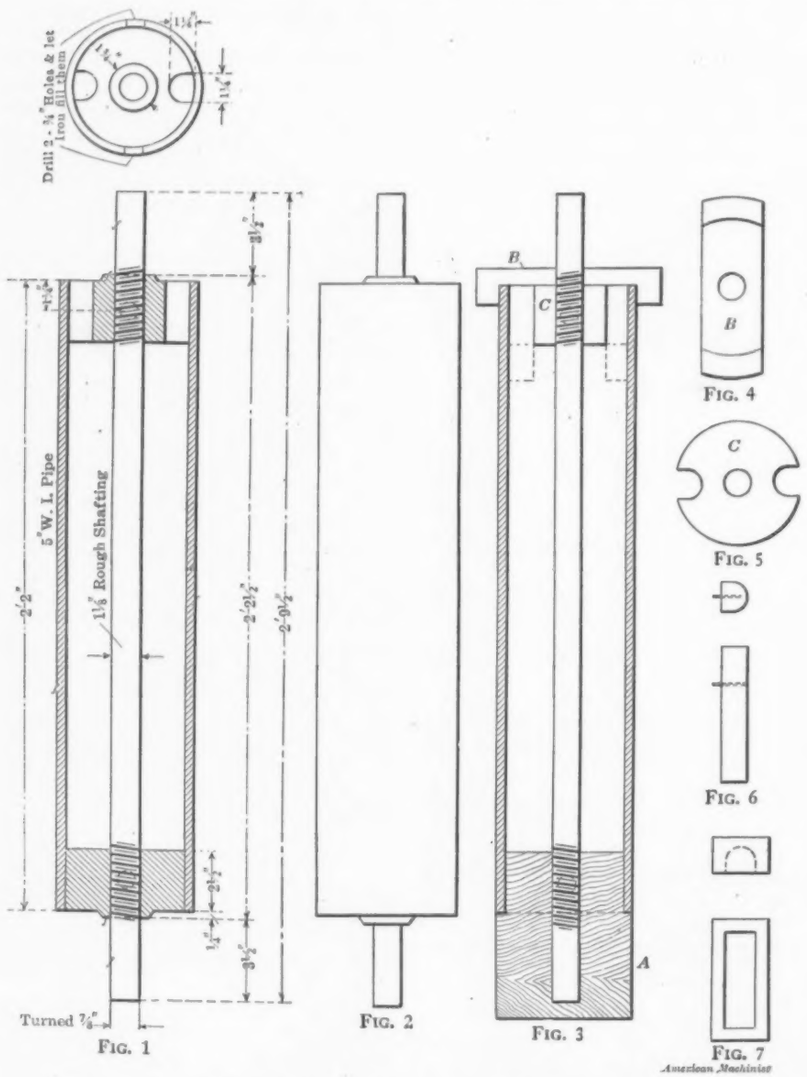



Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7

American Machinist

CASTING ENDS AND A SHAFT WITH PIPES FOR CONVEYER-BELT ROLLERS

## Modification of United States Form Sizing Taps

In making small thread gages for use in gaging screws, bolts and threaded parts, having a diameter smaller than ¼ inch, it is desirable that such gages be threaded out by means of sizing taps or hobs on account of the small amount of space in which to operate an internal-threading tool. It is also necessary that the thread cut therein be as sharp on its top as possible, thus providing clearance for the abrasive used when lapping, as well as making a place for dust and fine chips when testing the parts in the gages.

The following table used in connection with the making of sizing taps for gages having threads of United States form, will show the amount by which the outside diameter must be left oversize to produce a sharp top for the thread in the female gage.

| Threads per Inch. | Amount to Add. | Threads per Inch. | Amount to Add. |
|---|---|---|---|
| 3 | 0.0711 | 14 | 0.0154 |
| 3½ | 0.0666 | 16 | 0.0135 |
| 3¾ | 0.0618 | 18 | 0.0120 |
| 4 | 0.0541 | 20 | 0.0108 |
| 4½ | 0.0481 | 22 | 0.0098 |
| 5 | 0.0433 | 24 | 0.0090 |
| 5½ | 0.0393 | 26 | 0.0083 |
| 6 | 0.0360 | 28 | 0.0077 |
| 7 | 0.0309 | 30 | 0.0072 |
| 8 | 0.0270 | 32 | 0.0067 |
| 9 | 0.0240 | 34 | 0.0063 |
| 10 | 0.0216 | 36 | 0.0060 |
| 11 | 0.0196 | 38 | 0.0057 |
| 12 | 0.0180 | 40 | 0.0054 |
| 13 | 0.0166 | | |

AMOUNT TO ADD TO OUTSIDE DIAMETER OF U.S.F. SIZING TAPS TO PRODUCE THREAD WITH SHARP-V TOP.

F. CHARLES SCRIBNER.

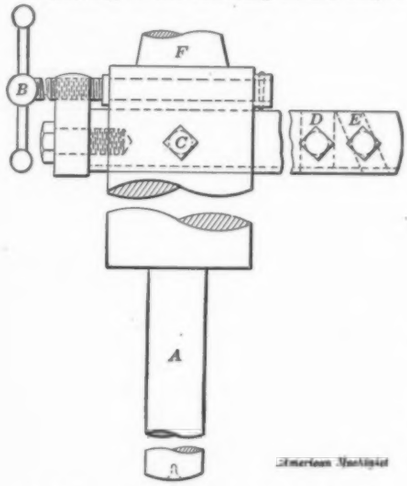
Greenfield, Mass.

## A Facing and Boring Tool for the Drill Press

Herewith is given an assembled sketch of a handy and reasonably efficient tool which converts the drill press into a boring and facing machine and I can say from experience that it is a valuable addition to the small shop where they have but one or two lathes usually run to the limit.

We designed this tool to do work larger than the capacity of one lathe and it did well enough for the large flanges for which it was used.

Referring to the lettering in the cut, *A*




A Facing and Boring Tool for the Drill Press

is the pilot which is guided by a bushing set into the center of the platen; *B* is a handwheel used to feed the cutter when facing, and *C* is a set screw used to lock the cutter bar when boring; *D* is the holder for the facing and *E* the one for the boring tool while shank *F* is turned taper to fit the regular socket in the spindle and is fastened in by a short key in the drift hole.

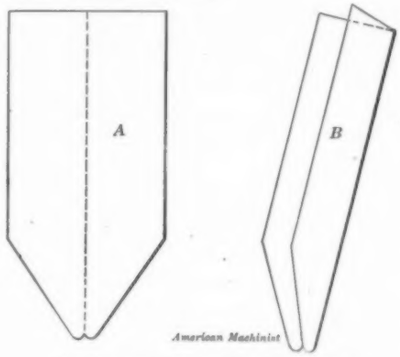
Tarrytown, N. Y. J. J. McHenry.

## An Improved Recorder Pen

The writer recently had occasion to fix up an autographic recorder in which the record is made in ink on paper wound once around a cylinder and held at the ends by a clip. This cylinder revolves while the tracing point moves in a straight up and down direction only, so that the motion of the pen relative to the paper may, therefore, produce a curve with great irregularities in it.

There were two pens which had been tried with the recorder but neither gave a satisfactory line except when the drum was stationary but as soon as the drum and pen were moved in unison the record became a wide blur. There was no reason to blame the ink for this, as it worked well enough when the pen was tracing vertical lines so it was evident that the pens were not shaped correctly.

The pens we had were simply strips of brass bent into a V-shape and pinched almost tight at one end, which was sheared off at a sharp angle and after several attempts to fix one of these pens to feed properly, the secret was found to consist in slitting the point of the pen back a short distance along the crease and rounding the point.




An Improved Recorder Pen

In making a pen for an instrument of this kind a piece of thin brass is cut out as shown at *A*, after which it is bent along the dotted line into a V-shape like *B*, and the thickness of the line to be drawn is regulated by pinching the tips together the proper amount.

A pen made in this way is therefore similar to a regular drafting pen at the point and feeds perfectly.

Easton, Penn. A. S. Merrill.

## Marking Patterns

Everyone who has the handling of patterns has experienced the difficulty of getting a mark that is distinguishable and at the same time permanent. The usual method of using cast letters gives a plain number or symbol, but the characters are liable to become loose and drop off, leaving the mark incomplete, and besides, the element of cost for these

Fig. 1 Fig. 2 Fig. 3

Marking Patterns

characters is an item where many patterns are made.

The method herein described, combines permanency, clearness and cheapness, and in addition is compact and easily applied to the pattern and consists of stamping the symbol on a strip of zinc or soft brass, of perhaps No. 26 gage, with special steel letters or figures, a block of babbitt or lead being used as an anvil. When marked in this way not only does the symbol show plainly on the pattern, but it is equally clear on the casting.

The punches used are similar to the usual steel letters used in the shop for marking finished surfaces, but differing in some respects: The common character has a V section and is reversed so that the stamped character will be in normal position and with sharp outline, as in Fig. 1, but the stamps used for this purpose are of a flattened V, or a U, section and are cut in normal position so that the impression is a reversed matrix as in Fig. 2. Each character is stamped separately, and when the required mark is complete, the portion of the strip is cut off with tinner's shears. The resulting tag is reversed, Fig. 3, and nailed to the pattern with small escutcheon pins or brads, or soldered if the pattern is metal.

The cost of each punch of the size shown is 50 cents, and the babbitt block may be surfaced when worn, or recast and used indefinitely. A similar method, more complete but also more expensive in first cost, has been used by one of our largest factories in the East, and good results lead the writer to improvise the above simplified form which gives equally good results. In the case mentioned, a frame holds the punches and also a corresponding impression die for each, and the whole symbol may thus be set up at one time, and the tag embossed as described.

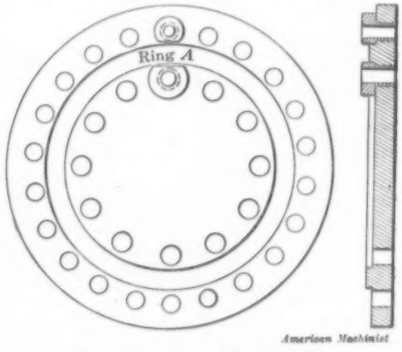
A simple experiment with the ordinary steel figures will do more to show the good results to be obtained than any further description, and in the places where this method has been used, it has always given satisfactory results.

Fred W. McArdle.

Roslindale, Mass.

## Holding Slip Bushings

Recently I had a large jig to design with several circles of many drill holes, and a very important item to consider



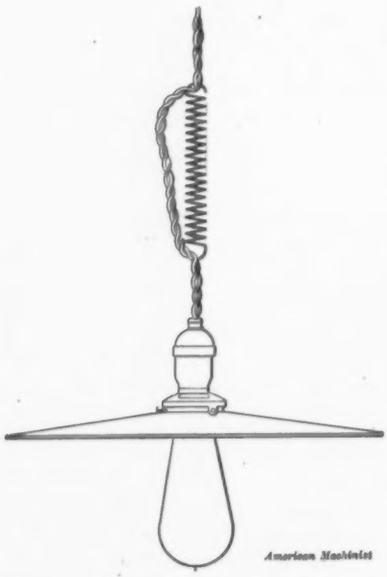

Holding Slip Bushings

was the cost. Slip bushings were used and the method of preventing them from turning, as shown in the sketch, was in this case, I believe, cheaper than any other way and served the purpose well and all that was necessary was to turn the ring *A* on the jig and grind a flat on the bushings.

Detroit, Mich. H. Sprague.

## Protecting Tungsten Lamps from Vibration

All who have to deal with Tungsten lamps no doubt have become acquainted with their extreme fragility. This lamp, however, forms the basis of a very economical shop lighting unit, when properly installed. The accompanying sketch shows how one shop does it. The spring




SPRING HANGER FOR TUNGSTEN LAMP

hooked in the cord takes up and absorbs all shocks and jars from the ceiling. It should be of about the same tension as the spring in a window shade.

Cincinnati, Ohio. R. A. RUDOLPH.

## Setting Dividers Accurately

It often happens that there are some holes to be located in relation to each other where a maximum error of 0.002 inch is allowed. In such cases I find the following method very satisfactory: Scribe a straight line on a piece of sheet brass and put a fine center-punch mark near the end of it, then set the dividers to the required dimensions on a scale and step them along the line, say, six times, scribing an arc across the line at the last step. The total distance thus stepped off, when measured with a scale, will show the error in setting the dividers multiplied by six. If the total error is too small to be readily seen when measured with a scale, it is safe to say that the error in setting the dividers is not more than 0.0005 inch. I find that a greater degree of accuracy can be obtained in laying out the holes if the point of the dividers is pressed sufficiently into the work to make a fine center mark, that can afterward be enlarged with a center punch, as I have always found it better to find the center thus, by sense of touch, rather than sight, although I do not advocate doing the job with the eyes shut. Holes thus laid off and trued up with a center tester should easily come within 0.001 inch of the correct measurements when bored on a lathe. This method can also be used to good advantage where the given dimension between holes does not coincide with any graduation on the scale, as for instance, 0.509 inch if multiplied by seven, would measure so near to 3 9/16 inches that an error of more than 0.0005 inch in setting the dividers would be easily discernible.

Ont., Canada. H. T. M.

## Initiative

It is stated by some of the critics of scientific management that it tends to stifle initiative on the part of the mechanic. This criticism is particularly directed at the methods of Fred. W. Taylor, and as the fundamental principles on which his methods are based aim at the destruction of the old incentive and initiative method of management, it might seem that there would be no place for original thought by the workman under the new methods.

In considering this criticism it is well worth while to see what we mean by initiative. Initiative is not a possibility or an opportunity, but a potentiality or capability; the actual ability to start something. All men are not equally gifted in this respect; this must be evident to the most bitter critic of the new scheme, from observation of men working under the old scheme of things.

There is just one best way of doing a job. And that is naturally the way the house wants it done, as it is the cheapest way and means the most money. If a job is assigned to a workman with only general directions, the worth of the methods he will follow will depend on the class of his initiative, and the house may or may not be best served. If, by chance, he got the best way in one job, there could be no certainty of his getting the best way in another, and it is a certainty that all the men in any shop will not get the best way all the time. It would be expecting too much of a man. A machine-shop foreman told me the other day that if a machinist could not set his machine for the proper cut, speed and feed, he just did not know his trade; and this is not by any means an uncommon belief. To one at all familiar with Barth's slide rule it would seem hopeless, in the light of that statement, to try to learn the machinist's trade.

The logical procedure would seem to be to take the mechanics of higher order of initiative and use their initiative in planning work for others, giving them the advantage of scientifically obtained data for the basis of their plans and detailing. This is the highest order of the use of initiative in the shop, and really stimulates its development. It cannot consistently be claimed by the advocates of the old way that such practice tends to stultify the general practice of the trade, for in almost any shop can be seen specialists on various classes of work, indicating that the mechanics do not practise all branches of their trade. This does not refer to special tool operatives, but to all-around mechanics and tool hands.

This same problem is disturbing other callings than that of the industrial manager, and its solution is not generally admitted in any. The problem of the engineering education will serve as an illustration anl analogy.

Eminent engineers have said that the college man is useless; or that it takes at least two years of shop work to make him worth anything; or that he cannot ever satisfy directorates as a manager, because he lacks the point of view regarded as a prerequisite. This is a real problem for the educators to solve; and they are far from agreement as to its solution.

One school believes in permitting the individual instructor to teach his subject in his own way, over such scope as to him seems best; another school would employ the highest talent to prescribe scope and method, and make the individual instructor conform to a settled policy.

Recently in the columns of the AMERICAN MACHINIST there appeared a letter from a professor of engineering, himself a college graduate, setting forth as an advantage of the college professor's career his absolute independence in practice. Compare this with the statement of Prof. George F. Swain, of Harvard University, one of the leading engineers and educators in this country, made at Schenectady last April: "Another common defect in our technical methods appears to be a lack of coördination. In many of our higher institutions, each teacher seems to be an unrestrained individual following his own way, not only *teaching* his own subject in such a manner as he pleases, but arranging his course and planning the ground to be covered without regard to anybody else."

What do the critics of scientific management really mean by "initiative?" Do the scientific methods really repress true initiative? Do all these critics comprehend scientific management?

Mare Island, Cal. F. J. COBURN.

As the result of a gift of $50,000 by Mrs. F. O. R. Lang, of Montclair, N. J., a new building to house the shops of the Sibley College of Mechanical Engineering, Cornell University, will be erected. Mrs. Lang presented this donation in memory of her father, Jasper N. Rand, and her uncle A. C. Rand, founders of the Rand Drill Company.

# Semi-Automatics in Automobile Work

## Editorial Correspondence

*Tool and chucking equipment for machining flywheels, cone-clutch wheels and gear blanks on Potte & Johnston machines.*

Some interesting examples of work on the Potter & Johnston semi-automatics at the E-M-F shops in Detroit, Mich., are shown in the accompanying illustrations. Flywheel work and the tools used are shown in Figs. 1 and 2, where different types of wheels are being turned.

This shows the use of overarm tools in connection with drills and reamers, and also gives an interesting roughing taper reamer being two-lipped, and stepped cutting edges to break up the chips.

The engine flywheel is shown in Fig. 2, a combined turning and boring tool being show as having just withdrawn from the work. It will be seen that this flywheel is bored on the inside of the rim to the taper of the cone clutch. This cone surface is secured by the use of the guide shown attached to the cross slide in front of the flywheel. The construction of the over arm tools is clearly shown, together with the form of tool used for rounding the edge of the flywheel. This is seen in the over-reaching arm at the right. The special tool holder on the end of the cross slide is also interesting.

Fig. 3 shows a clutch pulley being turned and bored with the smallest diameter next the chuck.

This is an aluminum casting, with a comparatively light rim, which afterward receives the leather face for the friction clutch. This rim is quite light and a broad facing tool does not give good results. Consequently the special turning tool shown on the end of the cross slide is used to produce this taper. A spiral groove in the journal of this tool at *A* controls its movement as it is forced in by the arm *B*, which is bolted to a face of the turret. In this way the rim is turned to the desired taper with a single-point tool at a correct angle automatically obtained.

Fig. 4 shows the way in which the expanding brake bands are handled. They are held by the special chuck jaws shown. This holds the rings so they can be turned before cutting. As will be seen, a center bushing steadies the turret and boring tools and aids in securing a good job.

The method of turning piston rings is shown in Fig. 5. The rings are cast in the shape of the usual piston-ring pot and are bored by the plain bar shown in the turret. The eccentricity on the outside is secured by the arm *A*, carrying the roller *B*, which runs on an eccentric ring on the

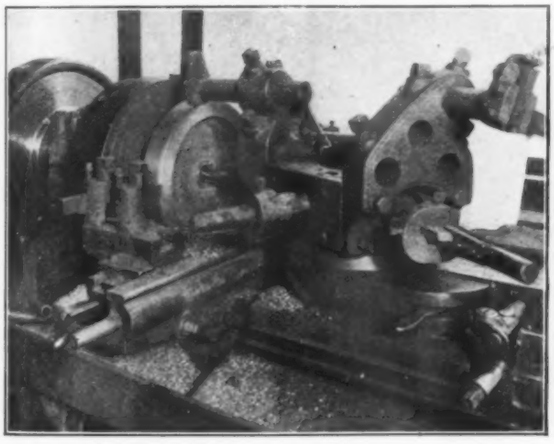


FIG. 1. FINISHING FLYWHEELS

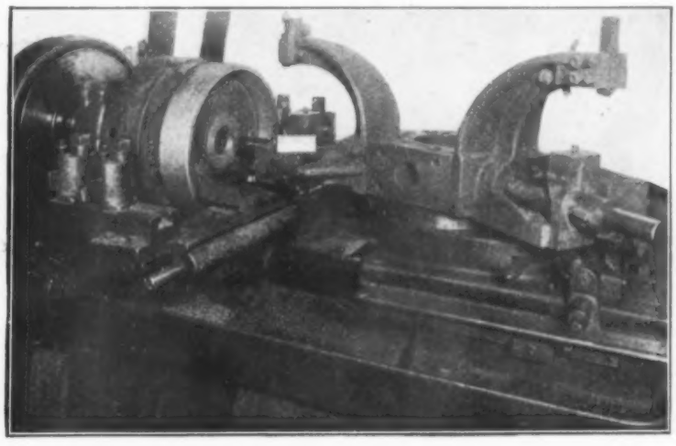


FIG. 2. TURNING AND BORING FLYWHEELS

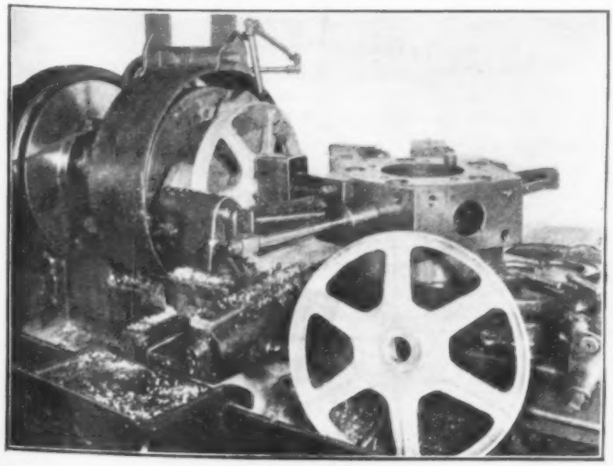


FIG. 3. ALUMINUM CONE-CLUTCH WHEELS

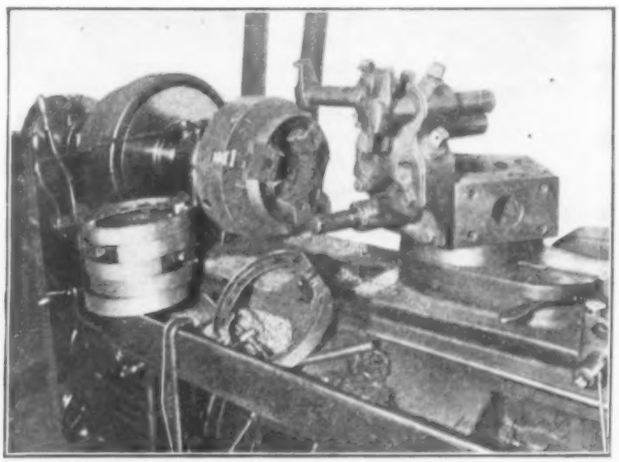


FIG. 4. FINISHING EXPANDING BRAKE BANDS

outside of the chuck. The action of the roller is controlled by the coil spring over the top of the turret so that the whole arm from the roller to the spring is pivoted in the pin *C*, and the tool *D* moves up and down, producing the desired eccentricity of the ring.

In Fig. 6 one of the turning gears is being turned almost all over by the tool shown. The blank is held by the three projections on the jaw going through tne holes of the gear blanks. This allows the hole to be bored, the hub faced on the outside, the rim turned and both sides of the rim faced, leaving only the inside face of the hub unfinished.

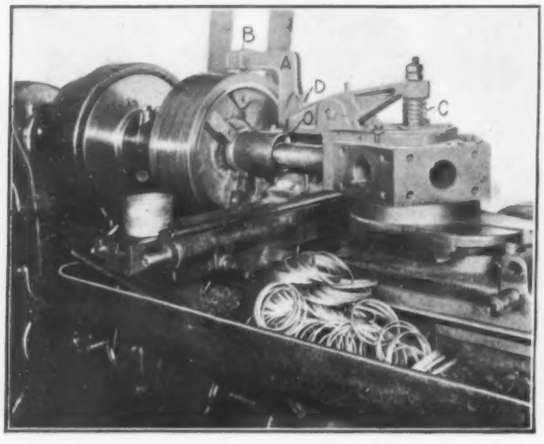



FIG. 5. TURNING ECCENTRIC PISTON RINGS

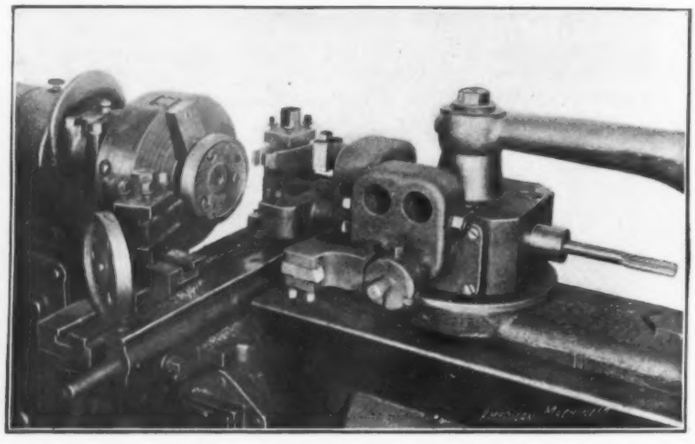


FIG. 6. CAM-SHAFT GEAR BLANKS

The small arm turning tools have a pilot for steadying them in the gear blank. Both cross-slide tool holders are used in this case.

## High Speed Flywheels for Power Storage

BY SELBY HAAR

In the early days of the manufacture of electric power, storage of power was employed mainly for the purpose of increasing the peak capacity of the generating station. The improvement of the load factor was realized, however, and taken into consideration also. Practically all generating stations were built for lighting service in which the load changes slowly. Storage batteries were used very successfully for this class of service. The ampere-hour capacity of a storage battery decreased, however, with the rate of discharge, so that a severe peak of short duration requires an expensive battery, with correspondingly high maintenance and operating costs.

Flywheel storage, on the contrary, is very well suited for absorbing peaks of short duration, and this type of power storage has found extended popularity in recent years. Its equalization is automatic so that it does not require attendance for recharging. The actual energy which can be stored probably is smaller than that of a battery, so that it is not so suitable for long periods of discharge.

There are two methods of applying flywheels. They may be connected to a generating machine inserted in the power circuit, or they may be arranged with a machine to "float" on the line. Either system may be adapted to both alternating and direct-current circuits.

Since the kinetic energy of a rotating mass varies as the square of the speed, it is important to use as high a speed as is practicable. Rim speeds of 24,000 to 30,000 feet per minute are quite possible, but the windage loss of an uninclosed flywheel at such speed is extremely high. 18,000 to 21,000 feet per minute is at present considered the most economical speed.

The General Electric Company has designed and built several high-speed flywheels of which we may mention one 10 feet in diameter, weighing about 39,000 pounds, which operates at a maximum speed of 600 revolutions per minute, or a rim speed of 18,840 feet per minute. Another one is 12 feet in diameter, weighs about 47,000 pounds and operates at 500 revolutions per minute maximum, which gives also a rim speed of 18,840 feet per minute. Still another one is 8 feet in diameter, weighs about 22,500 pounds and operates at 750 revolutions per minute, giving the same rim speed. A somewhat smaller one, 8½ feet in diameter, weighing about 8900 pounds, runs at 720 revolutions per minute which means a rim speed of 19,200 feet per minute.

The stored energy in the 10-foot wheel at 600 revolutions per minute, is 35,000,000 foot-pounds; of the 12-foot wheel at 500 revolutions per minute is 43,000,000 foot-pounds; of the 8-foot wheel at 750 revolutions per minute is 20,900,000 foot-pounds; and of the 8½-foot wheel at 720 revolutions per minute is 7,400,000 foot-pounds. A 30 per cent. reduction in speed releases 51 per cent. of this energy, amounting to 17,800,000, 21,900,000, 10,650,000, 3,760,000 foot-pounds respectively. If we assume the heat value of a pound of coal as 12,000 B.t.u. the complete combustion of this pound will set free $12{,}000 \times 778 = 9{,}336{,}000$ foot-pounds. Therefore, every time the flywheels above mentioned slow down from full to 70 per cent. speed, they give out energy equivalent to the total energy of 1.91, 2.34, 1.14 and 0.40 pounds of coal respectively. If this occurs 1000 times per hour, or about 17 times per minute, the flywheels will have absorbed and delivered every hour energy equivalent to 1910, 2340, 1140 and 400 pounds of coal respectively.

This, however, is not the whole story, for these figures for coal consider the utilization of the energy of the coal at 100 per cent. efficiency. In average practice, if this coal were burned under boilers to drive steam engines, the overall efficiency would be nearer 10 per cent., so it will be appropriate to multiply the above figures by 10, giving 19,100, 23,400, 11,400 and 4000 pounds of coal as commercially burned, represented in the energy absorbed and given out per hour by these flywhels.

Of course, this does not mean that these flywheels *save* this much, or any other amount of coal, as every foot-pound of energy given out by the wheels must first have been put into them by the motive power. They act simply to absorb the sudden surges of power and so keep the average within the capacity of the generating apparatus.

These flywheels are all of high-grade cast steel, finished all over and very carefully balanced.

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People living in the western part of southwestern Dakota are to be congratulated on having a never-failing supply of hot water for heating their houses and for other purposes. By drilling artesian wells they get spouters varying in temperature from 100 degrees to 130 degrees, and even higher. In Boise City, Idaho, about half the houses are heated by natural hot water.

Issued Weekly by the
Hill Publishing Company
JOHN A. HILL, Pres. and Treas. ROB'T MCKEAN, Sec'y.
505 Pearl Street, New York.

Correspondence on mechanical subjects solicited and paid for. Name and address must always be given—not necessarily for publication.

Subscribers can have address changed at will. Give old and new addresses.

Subscription price $4 per year, postage prepaid, to any post office in United States, United States possessions and Mexico. $5.50 to Canada. $7 in all foreign countries except Europe and British possessions in Eastern Hemisphere.

Hill Publishing Co., Ltd., 6 Bouverie St., London, E.C., will serve all subscriptions for English Edition for Europe and British possessions in Eastern Hemisphere. Price 30 Shillings for England. For all other countries in Eastern Hemisphere, 35 Shillings.

Published in the German language under the name of "Maschinenbau," by the Hill Publishing Co., A. G., 71 Unter den Linden, Berlin, N. W. 7. Price for Germany 24 M., Austria 29 K., Switzerland 32 Fr., other countries in Eastern Hemisphere 35 M., North or South America 40 M., or $10.

Entered at New York Post Office as mail matter of the second class.
Cable Address, "MACHINIST," N. Y.

*CIRCULATION STATEMENT*

*During* 1910, 1,488,400 *copies. For February,* 1911 *(American weekly, American monthly, English weekly and German weekly), total,* 121,000.

*Of this issue* 36,250.

*None sent free regularly, no returns from news companies, no back numbers.*

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# American Machinist

## Why We Cannot Print Syndicated Articles

Some of our good friends continue sending us illustrations and descriptions showing a new factory or the way their machines are used on certain work, and are frequently grieved to learn that we cannot use them when they are sent to other papers as well.

Everything except new machines and extracts from public papers must be written exclusively for the AMERICAN MACHINIST in order to give its readers features in the shape of information that they cannot secure in any other way.

Our readers expect and demand special consideration in the way of live articles which are not to be found elsewhere.

This is for precisely the same reason that makers of machinery would hardly expect to find customers for their machines if they were built exactly like all the rest. Customers demand special features whether they are buying machines or technical papers—the principle is the same in either case.

Using syndicated articles of any kind is exactly the same as though one of our contributors sent duplicates of his articles to other papers so that they appeared at the same time, receiving pay for all of them. For, while the maker of a machine which is mentioned in an article would not expect a check as a contributor, he does expect an equivalent in publicity or he would not send it to all the papers.

It is simply the remnants of a custom which has been fostered by weak papers to curry favor and to save paying contributors real money for their articles.

We are very sure that no manufacturer who will ask himself whether he would want to build his machines of exactly the same materials and with the same features as his neighbor can fail to see that in fairness to our readers, we must refuse "syndicated" articles.

For, after all, the readers are the real customers of us both and unless we can interest them with special features in technical papers, as well as in machines, we have no reason to expect their trade.

## Two Efficiencies

The report of Morris L. Cooke to the Carnegie Foundation on the efficiency of education, or rather on the efficiency of one branch of education in a very limited number of schools, appears to indicate that from a business standpoint our schools may be very inefficient and at the same time they may be very efficient in their real purpose—the education and training of young men for a professional life.

It appears to us that there are two very distinct efficiencies, but we do not consider them incompatible. One is the material efficiency, the other the moral.

The report above referred to deals with the material efficiency and very naturally finds it low. We say, very naturally, because it is only yesterday that we began to consider the subject of material efficiency in connection with education.

We have rated colleges and technical schools by the fame of their faculties and by one of the very things which Mr. Cooke deplores, the unproductive research work. Time was, and we hope still is, when men of large capabilities accepted the pitifully inadequate salaries of the schools in the hope that through the facilities and the leisure thus afforded they might add to the store of human knowledge and incidentally to their own glory.

The advent of the technical school in the ranks of colleges has undoubtedly done much to commercialize all colleges, but nevertheless it was inevitable that a certain degree of commercialism should creep in as time went on. We do not deplore this change for we feel that students herded away from the ways of the business world for four years are thereby deprived of a certain very necessary portion of their education, and we do feel that it is necessary to pay more attention to the material side of the case than formerly.

The spectacle of technical schools pleading for money for new buildings when their old ones average to be in use less than one-quarter of the school hours is nothing new; the begging for endowments to enlarge their faculties when their professors are handling less than half the students that other men are handling in other schools is not unknown. These conditions are only natural and are what would be expected in shops if they were run without competition.

The moral side of technical education, at least, is only to be investigated by acquaintance with their alumni. A small school with a few men of strong character on its faculty, even if they are of limited engineering ability, may apparently waste much of its income and yet turn out graduates who make their mark in the world and prove an ultimate efficiency far in excess of a school with an efficient organization from the material viewpoint and a brilliant engineering faculty lacking in strength of character.

The combination of an efficient administration and a faculty composed of brilliant engineers with strength of character

to permanently impress their students and graduates is perhaps too ideal for immediate consummation, but not too ideal to be beyond hope.

## The Advantages of Abandoning All Gages

Although much has been said from time to time in these columns in regard to the disadvantages of our many gage systems and the lack of uniform practice in regard to their usage, they are still with us.

Few of us probably realize the extent to which this confusion is carried in some lines of industry, and the unending amount of misunderstanding, differences of opinion, time lost in corresponding and actual cash losses due to delay and other causes, which seem unavoidable with our present practices.

The article on this subject in another part of this issue calls attention very forcibly to some of the reasons for all this difficulty and points out the advantages of following the recommendations of the American Society of Mechanical Engineers and the American Railway Master Mechanics' Association of 16 years ago. As far back as 1895 both of these well known societies recommended the use of a gage, whose number for each thickness is the number of thousandths of an inch in that thickness, and also recommended the abandonment of the various other gages then in use.

By the use of the decimal gage, which is in reality no gage at all, as it is simply the expressing of the thickness or the diameter in thousandths of an inch, they had in mind the doing away with the widespread confusion which still exists. The advantage of doing this has been recognized by some of the larger manufacturing companies, who have entirely abandoned the use of gage numbers of any kind and give all dimensions in thousandths of an inch.

The author of the article in question points out the glaring absurdities of giving gage sizes in dimensions so fine that they are practically unmeasureable in any commercial work, and also the changing of the kind of gage used at an arbitrary point in certain kinds of material.

There are few practices in our modern manufacturing where radical changes are more sadly needed or where they will save more money than in the question of wire and sheet-metal gages, and we hope that the article in question will be seriously considered by those who are suffering inconvenience and loss from their continued use.

## The Need of Standard Names

Few will question the advantages of having a standard for bolt sizes, even though a finer thread has been found more desirable in some cases. In the same way the standard wire gages, standard tapers and standard pipe threads have helped to make parts interchangeable even if we have not come to a single standard in any except the last.

But fully as confusing as any differences in gage numbers, tapers or other details, are the different uses of the same name in shop nomenclature and the calling of the same part by several names, as is too often the case.

This not only makes it confusing to apprentices but is a source of much misunderstanding that eats up more time and postage stamps than we are apt to realize. Few builders who have to do with repair parts, but can testify to the great variety of names which are applied to various parts of the machine. The terms bearings, bushings and boxes are used indiscriminately in many cases and even the term journals comes into the same list in some cases.

In the same way key, spline or feather may mean the same or entirely different things to different people. Mandrel and arbor we are gradually straightening out so that the former is usually understood to mean the bar or shaft for holding work, while arbor refers to the device for driving the milling cutter or other cutting tool.

These are encouraging signs in some quarters, and we trust that the desire for a standard naming of parts may become stronger until it results in concerted action. For it means more than a convenience to a few, it has a bearing on the economics of the industry, in addition to avoiding little misunderstandings which sometimes make life a burden for the time being.

## New Publications

Applied Thermodynamics. By H. W. Spangler. 160 6x9-inch pages; 76 illustrations in the text, indexed. John Joseph McVey, Philadelphia, Penn. Price, $2.50.

This book contains the substance of a lecture course given by the author to engineering students in the University of Pennsylvania. It is intended to be taken up following some elementary treatise on thermodynamics, and many of the methods used are presented without their detailed derivation. Professor Peabody's tables of the properties of steam and other vapors have been used in the preparation of the text. It is pointed out that one of the most unsatisfactory sections of the book is that relating to absorption machines, as the available data are so meager that an attempt at the thermodynamic treatment can be only tentative. The chapter headings are: Flow of Gases and Vapors; Flow of Steam; Efficiency; Air Engines; Steam Engines; Steam Engine Tests; Refrigeration; Absorption Machines; Internal Combustion Engines; Evaporators.

## Personals

George L. Bourne, who was formerly vice-president of the Railway Materials Company, Chicago, Ill., has become vice-president of the Locomotive Superheater Company, Chicago, Ill.

J. W. Paul, until recently superintendent of the Pittsburg Writing Machine Company, Kittanning, Penn., has accepted a similar position with the Standard Typewriter Company, Groton, N. Y.

L. M. Zach has resigned as mechanical engineer with the Wells Brothers Company, Greenfield, Mass., in order to take up duties in a designing and estimating capacity with Wickes Brothers, Saginaw, Michigan.

W. H. Fitzpatrick, Jr., for the past several years associated with the Detroit Foundry Supply Company, has severed his connection with that concern, and is now representing the S. Obermayer Company, of Cincinnati, Ohio.

J. Alexander Wilson, for five years with Vandyck Churchill Company, and seven years with the Pond Machine Tool Company, is now representative for Manning, Maxwell & Moore, with headquarters in Philadelphia, Penn.

Grant B. Shipley, until recently acting in the capacity of engineer in the mining and timber-treating department of Allis-Chalmers Company, has become president and general manager of the Pittsburg Wood Preserving Company, Pittsburg, Penn.

Sterling H. Bunnell, works manager of the Griscom Spencer Company, has resigned to open an office at 90 West street, New York, as a specialist in factory system and consulting engineer. Mr. Bunnel is the author of "Cost Accounting for Manufacturing Plants," now in press by D. Appleton & Co.

F. R. Humpage, W. L. Gleason, J. J. Ramsey and E. P. Chalfant have all resigned from the Packard Motor Car Company to join the reorganized E. R. Thomas Company, of Buffalo, N. Y. E. P. Chalfant will be president, F. R. Humpage, vice-president and general manager, J. J. Ramsey, secretary and W. L. Gleason, factory manager.

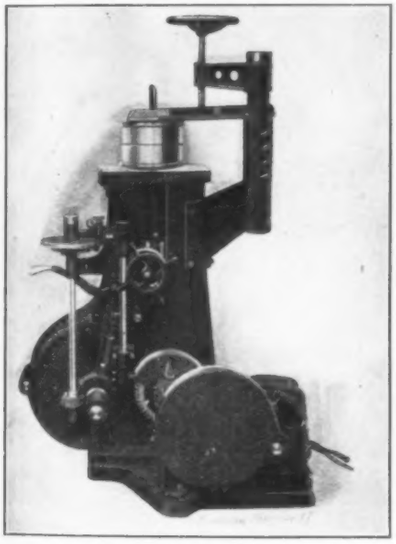
Although the figures from all the countries producing large quantities of tungsten are not yet available, enough are at hand to show that the world's production for 1909 was larger than in 1908, and was possibly equal to that of 1907. The estimated output for 1909 was 5289 short tons of concentrates containing 60 per cent. of tungsten trioxide, compared with 3898 tons in 1908 and 6062 tons in 1907.

# Shop Equipment News

ANY and all new or improved machines, tools or shop appliances of interest to men responsible for results in machinery-making plants will be briefly illustrated and described here — the machine shop news.
A more full and detailed description will be given — when it is real news — if it can appear here first — before it is sent to other papers. ALL descriptions appear in ALL four editions of the paper—Weekly, Monthly, Weekly English and Weekly German

## Lapointe Motor Driven Vertical Keyseater

The Lapointe Machine Tool Company, Hudson, Mass., has equipped their No. 1 type of keyseater with 2-horsepower motor drive, as shown. The cutters have from 10 to 20 teeth and each tooth cuts its part as the cutter is pulled through, cutting 0.010 inch at each stroke, 16 strokes to the minute, and it automatically clears on the return stroke, avoiding drag on the work, and is kept centered by a bushing. The depth of the keyway is regulated by an index plate and locked



LAPOINTE VERTICAL KEYSEATER

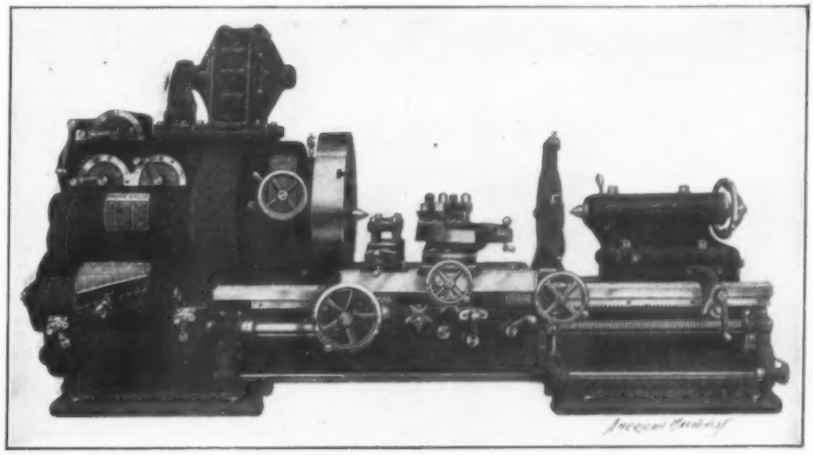
finger which is positive in action, the feeding being automatic. The machine will weigh about 975 pounds and takes a floor space of 36x40 inches.

## New 36-and 42-inch Lathes

The American Tool Works Company, Cincinnati, O., are building the lathe shown in the 36- and 42-inch sizes and in cone, geared-head, single-belt or motor-driven styles. A 20-horsepower motor is recommended for the motor-driven type. The 36-inch has a standard bed of 12 feet; takes 4 feet between centers with geared head and 5 feet with cone head.

Sixteen spindle speeds are obtained in the geared-head type through clutches and slip gears, the clutches being of the selective type while the slip gears are so made as to easily mesh. Of the 16 speeds, 8 are obtained directly through the spindle gear and 8 through the face-plate drive. The gears are all mounted on long bronze sleeves, oiled from the outside by means of sight-feed oilers. There is only one gear in the spindle which is set close against the front spindle bearing for the purpose of doing away with any severe torsional strains. The driving pulley is bronze bushed, runs on a steel sleeve to relieve the driving shaft of belt pull and is self-oiling, the hub forming a retainer for the oil which is fed to the shaft by felt wipers.

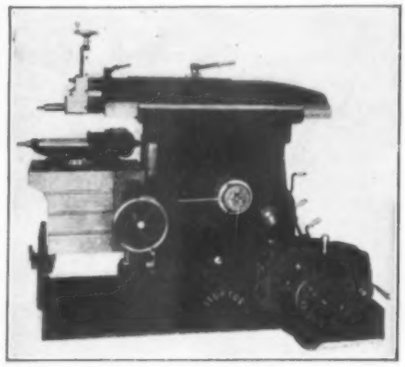
The quick-change gear mechanism has all steel gears, and provides 32 fundamental changes of threads ranging from 1 to 14 per inch; a compound quadrant gear at the end of the bed furnishes 16 additional changes, giving 48 thread and feed changes from ½ to 28 threads, including 11½ pipe thread, and from 4 to 244 cuts per inch. The coarse threads and feeds are obtained through the cone and no member of the box runs faster than the initial driving gear. A reverse plate at spindle gear arranges for either right- or left-hand threads, and index plates in full view of the operator show exact setting for each thread or feed.



NEW 36- AND 42-INCH LATHE

## A 24-inch Back Geared Shaper

The halftone shows a motor-driven crank shaper with speed box built by the



A 24-INCH BACK-GEARED SHAPER

John Steptoe Shaper Company, Cincinnati, Ohio.

Four changes of speed are secured through the speed box, and by means of

the back gears, eight changes are secured.

The machine can be stopped or started by means of a clutch which operates in the hub of the large gear. One pound pressure on the clutch lever gives 128 pounds pressure on the ring, so that the machine can be started or stopped almost without any effort on the part of the operator.

All of the clutch mechanism is fully inclosed, thus avoiding the possibility of accidents.

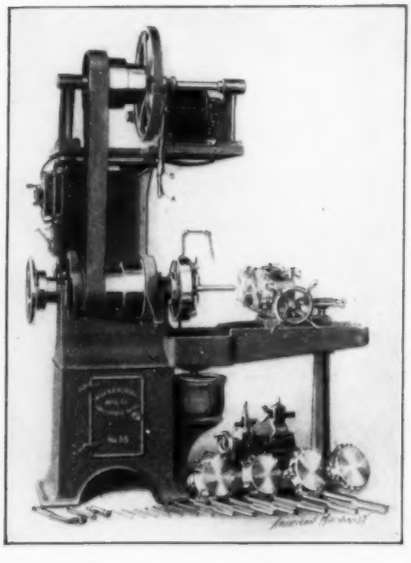
The speed box is so arranged that no clutches are used, and, therefore, there are no gears running idle on the shaft, avoiding any possibility of noise, or wear on the hole in the gears. When one gear is shifted in position, the other is shifted out, thereby making a very effective drive.

The motor used is a General Electric Company 3-horsepower, constant speed, running about 1200 revolutions per minute.

The machine is also built for belt drive, in which case a single wide-faced pulley takes the place of the gear driven by the pinion on the motor shaft.

## A Bolt, Nut and Pipe Threading Machine

The halftone shows a new motor-driven machine made by the Wiley & Russell Manufacturing Company, Greenfield, Mass. The machine is their stand-



A Bolt, Nut and Pipe Threader

ard machine equipped with opening dies.

A bracket is bolted to the bed, on this the motor shelf is secured. This shelf is hinged at the back and has finished projecting lugs, which rest on the cam shaft operated by the lever *A*. By this sufficient tension can be kept on the belt at all times and the belt can be slackened off when desired to shift it from one step to another on the cone pulley. After the belt is tightened the cam shaft is locked by a binder.

The lever *B*, in front of the motor, controls the clutch in the large spur gear so that the bolt cutter can be stopped independently of the motor. The motor is constant speed and back geared.

The machine cuts bolts and pipes to 2 inches in diameter.

## Plain 15-inch Engine Lathe with Geared Feed

The lathe illustrated by the engravings herewith, is provided with a three-step driving cone, double back gears, and a new feed box giving three changes

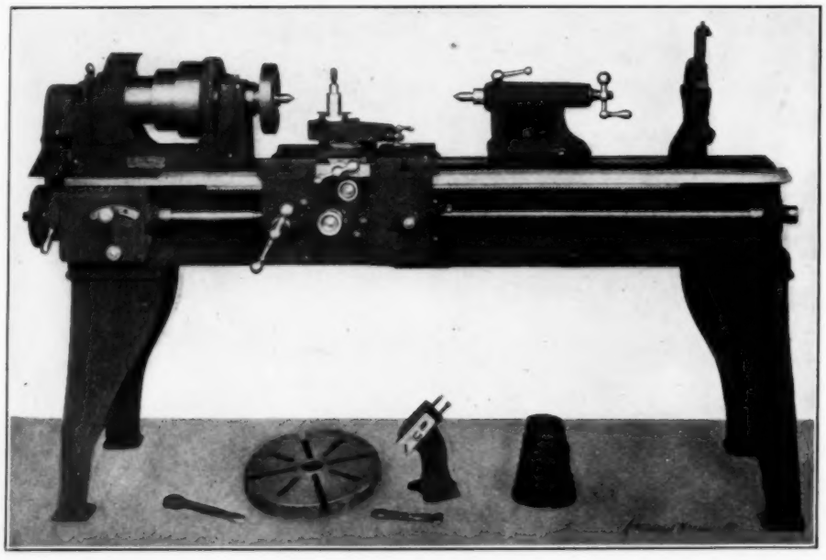


Fig. 1. Carroll-Jamieson Plain 15-inch Engine Lathe with Geared Feed

by the manipulation of the single handle shown. By changing the gears at the end of the gear box an unlimited number of feeds for both turning and screw cutting may be obtained.

The spindle, which runs in bronze boxes, is operated by a 2½-inch belt on the three-step pulley; the double back gears having ratios of 8 to 1 and 3 to 1. There are four cap screws for the front bearing and the head itself is secured to the bed by screws located directly under the bearing to obviate vibration.

The carriage is gibbed front and rear, and the cross slide, like the carriage, is provided with liberal bearing surfaces. The cross slide is fitted with taper gibs.

The construction of the gear box is shown in the line engraving, Fig. 2. In this box there are three pairs of gears and one clutch. When the double gear *A B* on the upper or driving shaft, is engaged with the clutch formed on the inner end of the driving gear *C*, the drive is transmitted directly to the feed screw. When the sliding double gear is slipped out of engagement as in the drawing, the feed-screw drive is disconnected, but when the gears are slid a little further the power is taken through gears *C D* and *E A*, and if the gears *A B* are moved to the extreme right, the drive is through gears *C D* and *F B*.

The lathe is built by the Carroll-Jamieson Machine Tool Company, Batavia, Ohio.

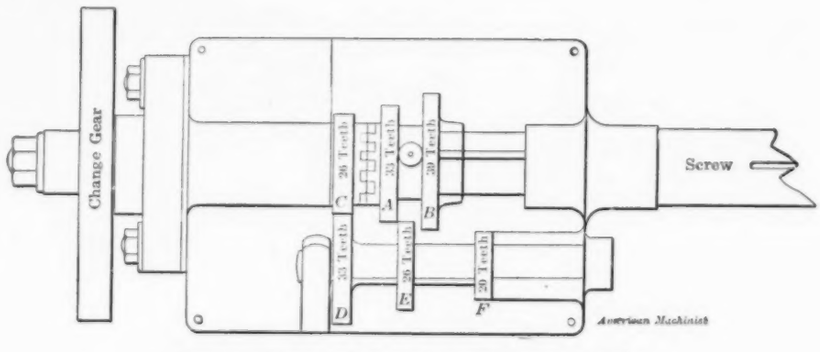
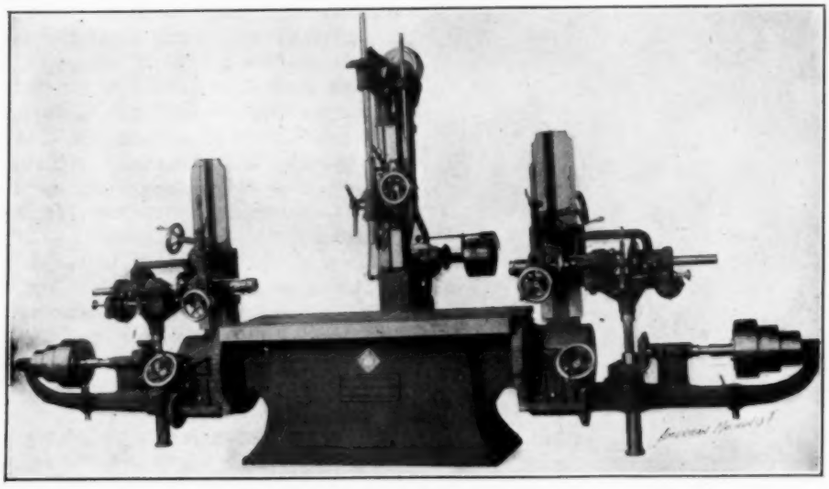



Fig. 2. Feed Box for 15-inch Engine Lathe

## Barnes Special Three Head Drill

The W. F. & John Barnes Company, Rockford, Ill., has put out a drill, illustrated in the halftone, made up of a special bed and the main parts of two of their regular No. 3 horizontal radial drills, and one sliding-head gang drill adjustable lengthwise of the bed. The cone pulleys of the horizontal heads are back geared, take a 4-inch belt and the spindles have a travel of 18 inches, while the vertical spindle is 14¾ inches in length and all have automatic stops. The machine weighs 7000 pounds and covers a floor space 7x16 feet.



BARNES SPECIAL THREE-HEAD DRILL

face of table, 14½x48 inches; feed to table, 32 inches; maximum distance of table to spindle, 24 inches; minimum distance of table to spindle, 3 inches; the head has a vertical movement of 21 inches and a bearing on the column 19 inches wide by 25½ inches long, the spindle is 4 inches in diameter at taper by 3 inches at upper end. It has an adjustment of 6 inches by means of sleeve and worm gear. There are twelve speeds to the spindle, nine back-geared and three high, open-belt speeds for small cutters, with twelve changes of feeds.

The drive is through a three-step cone pulley, and the speed of countershaft is 390 revolutions per minute. Three speeds for each step of the cone are instantly obtained through the back gearing by the manipulation of the vertical lever shown. The two levers are interlocking, preventing any two conflicting combinations of gears being engaged at the same time. By placing the vertical lever in its neutral position, the sliding gears are all locked out of mesh, then by moving the lower of the two levers to the right, the clutch is engaged with its mate which is cut on the end of the shaft carrying the cone pulley and the three high speeds obtained direct from the cone to the bevel gears on the vertical shaft. Twelve speeds to the spindle can thus be obtained.

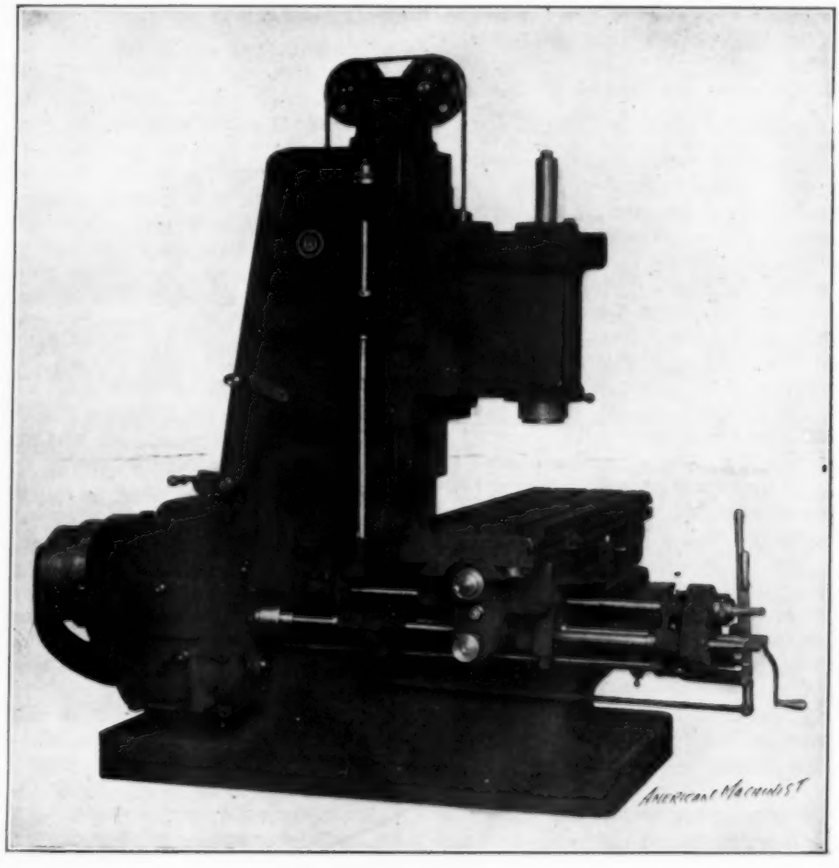
All shaft bearings are provided with wool-felt oil retainers. An efficient means is provided for oiling the driving shafts and feed box. Each bearing is connected by a soft-brass tube 5/16 inch in diameter brought up to a convenient location and grouped together in an oil cup with hinged cover. Two of these can be seen on top of the feed box. The net weight of the machine is 6800 pounds.

## Rockford Vertical Milling Machine

The accompanying halftone shows a new vertical milling machine recently brought out by the Rockford Machine Tool Company, Rockford, Ill. It is adapted to modern manufacturing methods and the production of duplicate parts. The machine is a radical departure from the old precedent, the adjustable knee, which is in common use.

The column and the horizontal slide for the saddle are made in one casting. By this construction, the table is not adjustable vertically, the top of table being 30 inches from the floor, the same hight as a planer platen, which is most convenient for the operator in handling castings or other parts being machined. The head bearing on column is large, while the weight of the head is counterbalanced, thus relieving the bearing of overhang and uneven strains tending to destroy accuracy.

The general dimensions of the machine are as follows: Distance from center of spindle to column, 15 inches; total length of table, 56 inches; working sur-



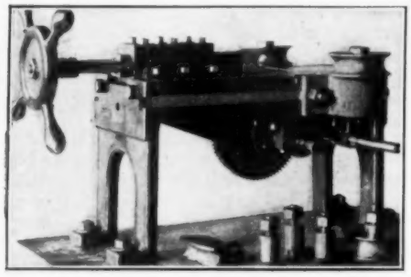
ROCKFORD VERTICAL MILLING MACHINE

## Power Bender and Straightener

This machine was designed for bending and straightening pipe, structural iron, round and flat bars of various kinds and sizes.

It is only necessary to have on this machine one set of dies for the different diameters. These may be set in different locations and permit of bending an infinite variety of shapes, as well as radii.

The machine is belt driven and the ram is actuated by an eccentric shaft of small throw and moves with a fixed stroke. The shaft is powerfully back geared, giving the ram a high power. Sliding in this reciprocating ram is another, which carries the former to be used, and this is moved in or out by a screw operated by the



POWER BENDER AND STRAIGHTENER

hand wheel. This gives a very delicate means of adjustment in manipulating the work and bending to the exact requirement. The machine is manufactured by H. B. Underwood & Co., Philadelphia, Penn.

## Solid Adjustable Die Head

The accompanying half-tone illustrates a new type of die head known as a "solid adjustable die head," recently brought out by the Landis Machine Company, Waynesboro, Penn. Its purpose is to take the place of the solid dies now used on any of the screw machines and other types of machines wherein the work is backed out of the die after the thread is cut.

The 1-inch standard size illustrated herewith has a range from ¼ inch to 1 inch. The dies are adjusted to and from the center on radial lines for different sizes and are held rigidly in their seats.

The die head is held in the turret of any ordinary screw machine and trips off by retarding the forward movement of the carriage. The tripping arrangement is so arranged that when the desired length of thread is cut, the die head will trip and revolve with the work until the machine has time to reverse. This type can also be obtained without the tripping device for special requirements.

High cutting speeds are readily acquired with this type of head.

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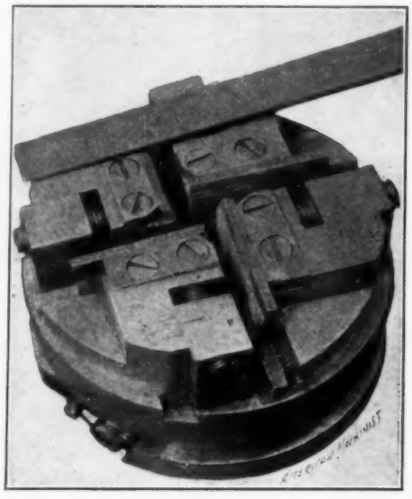
These heads can be supplied in standard sizes with shanks suitable for holders in ordinary screw machines. The



SOLID ADJUSTABLE DIE HEAD

1-inch head is 4⅝ inches in diameter, capable of cutting a thread 2½ inches long.

## Electric Transformers

The Triumph Electric Company, Cincinnati, Ohio, has recently placed upon the market a new line of power and lighting transformers of the improved shell-type construction.

The makers call attention to the fact that this new type of transformer has been designed with a view to good regulation, low copper losses, and low core-loss values, a superior quality of silicon alloy steel being used in their construction. The steel used is claimed to be non-aging even at temperatures well beyond the safe working limit of the transformer. They are dried under vacuum and impregnated with a special insulating compound, absolutely non-soluble in oil and possessing a very high melting point.

These transformers, known as the L type, are built for single-phase circuits, and are of the pole-type construction. The normal frequency is 60 cycles, but the frequency limits are from 50 to 140 cycles. Standard voltages are 1100-2200 for the primary, and 110-220 for the secondary.

## Ethics of Misusing Machinery

BY JOHN R. GODFREY

I sometimes get discouraged when I think of the many cases where machines and the various apparatus that come into play around the shop, or foundry, are either entirely neglected, or used in such an inefficient manner as to make them practically worthless. And I should think that makers of such devices would tear their hair, and otherwise disturb the peaceful atmosphere of their office, when they realize that this very neglect is condemning their apparatus in a way that is is often impossible for them to counteract.

It would not be so bad if they had an opportunity to go to each man who receives a wrong impression in regard to it, and show him where the faults lay. For, while this would be expensive, it would prevent the spreading of the harmful misinformation which now goes from one end of the line to the other without the manufacturer being able to defend his apparatus in any way, except by continued advertising, and this is very apt to be discounted on account of the aforementioned rumors.

The latest case of this kind which has come to my notice has to do with autogeneous welding apparatus, and shows not only the loss of money to the user, but the positive danger which may result from such cases.

In case No. 1 a certain railroad shop wanted a welding outfit which could be carried from place to place, and very properly wanted it at the lowest possible price. But, instead of buying an outfit designed for this work, they bought a small stationary outfit, mounted it on a truck all unknown to the manufacturer, and rejoiced at the apparent saving they had made. The first the maker knew of this was when it was illustrated in a railroad paper. He took the first train to the shop and proceeded to show them that while they had saved a few dollars they were playing with a danger they knew not of.

Not that portable outfits are necessarily dangerous, but they must be built for the purpose. A house heating boiler is all right in its place but it isn't the best for a racing yacht.

If this outfit had exploded, as it had every right to do under the circumstances, the maker would have been blamed, would have received much adverse criticism which would have injured his business, and yet would have been entirely innocent in the matter.

In case No. 2 a welding outfit was installed in a large steel plant. A representative happened to be in the neighborhood and went in to see how it was doing, only to be informed that it was being used but wasn't half what they had claimed for it.

A little investigation showed that the apparatus was being used by a laborer at about $1.50 per, who couldn't speak English and who had no idea of the proper use of the torch. Worst of it all was that the works manager seemed to be perfectly satisfied and resented any interference with his management. Yet the apparatus was being discredited every day to the injury of the maker.

How far has the user a right to injure the maker in this way, even if he has bought the apparatus?

# Pointers on Stock Gages in Press Work

By W. H. Sirius

Fig. 1 shows a safety stock gage that came to us through a State factory inspector. It is designed principally to keep the stock from slipping over the top of the gage. A notch is filed in the business end of the gage, near the top and the top edge is filed to a point so that the stock (thin goods, of course) either goes over the top at once or else is in a position where it cannot slide over the gage after the press is tripped. All our stock gages, whether bent or straight pins, are notched about 1/16 inch deep.

A gage designed to overcome the objectionable features of the two-point gages generally used on large work, is shown in Figs. 2 and 3. A gage in position *A*, Fig. 2, interferes with work falling out of the die. This is generally avoided by picking up the work in the punch and lifting it high enough to fall clear; then with large work the difficulty shown in Fig. 4 is encountered; the work in falling strikes the gage, denting or marking it, in some cases hanging on and interfering with feeding the stock.

Two pins spaced wide enough apart to allow finished work to drop through avoids all the foregoing troubles, but finds new ones, as the corners of the sheets of tin often are bent or clipped off entirely and, unless there is considerable difference in size between the blank and work, sheets ⅛ inch larger than the blank cannot be used. The gage shown in Figs. 2 and 3 eliminates all these obstacles; the two pin gages *G G* are placed to allow for all bad corners on narrow sheets and the falling work is lifted over the tops of the gages by the skid *B* made of ¼-inch wire, or of sheet iron. The dotted lines in Fig. 2 show a sheet in position, the dotted circle showing the work just clearing the tops of the gage pins. This will be better understood from the side view, Fig. 3. It has proved very successful.

Fig. 5 shows how we locate gages to space stock from different outlines. The first blank is cut from the square edge of the sheet, while the shape of the blank has no such edge. The intersection of the outline of the blank and the square edge when the proper bridge of stock is allowed in both cases, determines the position of the gages *G*. Larger blanks with a smaller angular opening are more profitably cut in pairs in the manner shown in Fig. 6, turning the sheet end for end. Fig. 7 is a gage used on a follow die that permits the work to fall unobstructed, gages close and permits the die to be in sight at all times. This plan gages easily and does not depend on the skill of the operator.

A similar plan is used in Fig. 8, where two large and two small circles are cut from one sheet, known as a combination layout. The pins are spaced to permit free passage of the work, and the large circles are located from the smaller circles already cut. There is but a small margin of scrap and this plan minimizes waste from chips. Combination layouts are not as well known as they should be, as they save considerable where quantities are concerned; in a case of this kind, four out of a sheet, a ratio of diameters of 1 to 1.4 will save the most stock. The extra handling is insignificant and costs but little. We figured $300 clear on half a million sheets used in the past year for just one layout.

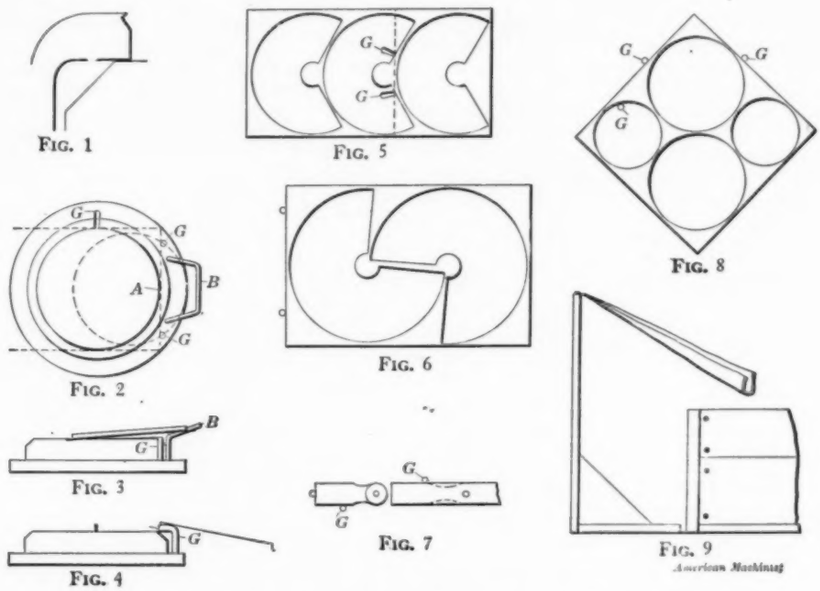



Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9.

Pointers on Stock Gages in Press Work

Another economy in cutting stock is worth noting. When cutting strips from sheets of brass, do not cut up an entire sheet and leave a small end that probably will be scrap. Divide the cutting between as many sheets as the case warrants and leave long ends that will be useful for almost any job that may come along. Use these ends in preference to full sheets when they show equal results, but not when they will leave a scrap piece, when that could be saved by cutting full sheets and leaving large pieces in stock.

My final suggestion concerns presses more than gages. We run a number of bridge dies, where the work from the cutting or other die falls into a second die, located back of the first one. It is easy to watch the first die and see that the work drops properly, but it is pretty hard to find a position that will enable the operator to feed the sheet, blanks or shells, as the case may be, and still watch the back die to be sure the pieces are being ejected. We have taken this from the operators' eyes and put it to her ears, by allowing the work from the back die to drop on a sheet of tin before falling into the box provided therefor. Fig. 9 shows the idea. The sounding pan is moved to any press that may need it and will increase an operator's confidence and production, and still safeguard the tools.

# International Industrial and Trade Exposition, Turin, 1911

Contrary to expectation, the preparations for the International Exposition, at Turin, Italy, have lately been taken hold of with such avidity at home and abroad, that the coming fair is likely to surpass the one held in Brussels last year. Of the space whose allotment has recently begun, comparatively little remains untaken. The total space covered by the fair grounds amounts to 12,000,000 square feet, of which 3,000,000 square feet—hence more than at Brussels—are occupied with buildings.

As is appropriate to the locality, the architecture follows the Piedmontese style of the Eighteenth century. All buildings are erected by the Italian government, and they are rented out to individual countries. The interior equipment is to be taken care of by the nations using it. Among the States which have applied for allotment are the following: Germany, 280,000 square feet; France, 230,000; England, 200,000; United States, 130,000; Brazil, 90,000; Belgium, 60,000; Hungary, 50,000; Switzerland, 37,500; South American Republic, 29,000; Japan, 23,500; Austria, 20,000; Servia, 6000; Persia, 5000; China, 5000, and Siam, 3500. The exposition is expected to open May 1.

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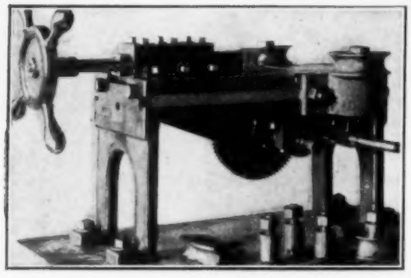

POWER BENDER AND STRAIGHTENER

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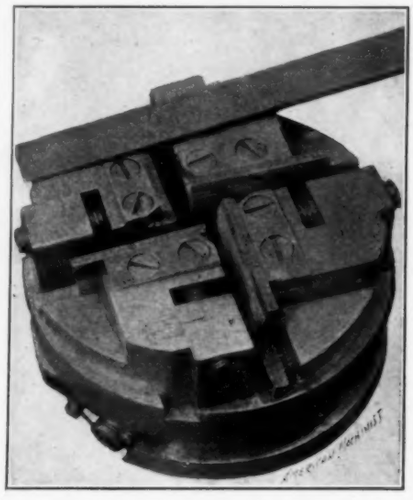

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Fig. 5 shows how we locate gages to space stock from different outlines. The first blank is cut from the square edge of the sheet, while the shape of the blank has no such edge. The intersection of the outline of the blank and the square edge when the proper bridge of stock is allowed in both cases, determines the position of the gages *G*. Larger blanks with a smaller angular opening are more profitably cut in pairs in the manner shown in Fig. 6, turning the sheet end for end. Fig. 7 is a gage used on a follow die that permits the work to fall unobstructed, gages close and permits the die to be in sight at all times. This plan gages easily and does not depend on the skill of the operator.

A similar plan is used in Fig. 8, where two large and two small circles are cut from one sheet, known as a combination layout. The pins are spaced to permit free passage of the work, and the large circles are located from the smaller circles already cut. There is but a small margin of scrap and this plan minimizes waste from chips. Combination layouts are not as well known as they should be, as they save considerable where quantities are concerned; in a case of this kind, four out of a sheet, a ratio of diameters of 1 to 1.4 will save the most stock. The extra handling is insignificant and costs but little. We figured $300 clear on half a million sheets used in the past year for just one layout.

Another economy in cutting stock is worth noting. When cutting strips from sheets of brass, do not cut up an entire sheet and leave a small end that probably will be scrap. Divide the cutting between as many sheets as the case warrants and leave long ends that will be useful for almost any job that may come along. Use these ends in preference to full sheets when they show equal results, but not when they will leave a scrap piece, when that could be saved by cutting full sheets and leaving large pieces in stock.

My final suggestion concerns presses more than gages. We run a number of bridge dies, where the work from the cutting or other die falls into a second die, located back of the first one. It is easy to watch the first die and see that the work drops properly, but it is pretty hard to find a position that will enable the operator to feed the sheet, blanks or shells, as the case may be, and still watch the back die to be sure the pieces are being ejected. We have taken this from the operators' eyes and put it to her ears, by allowing the work from the back die to drop on a sheet of tin before falling into the box provided therefor. Fig. 9 shows the idea. The sounding pan is moved to any press that may need it and will increase an operator's confidence and production, and still safeguard the tools.

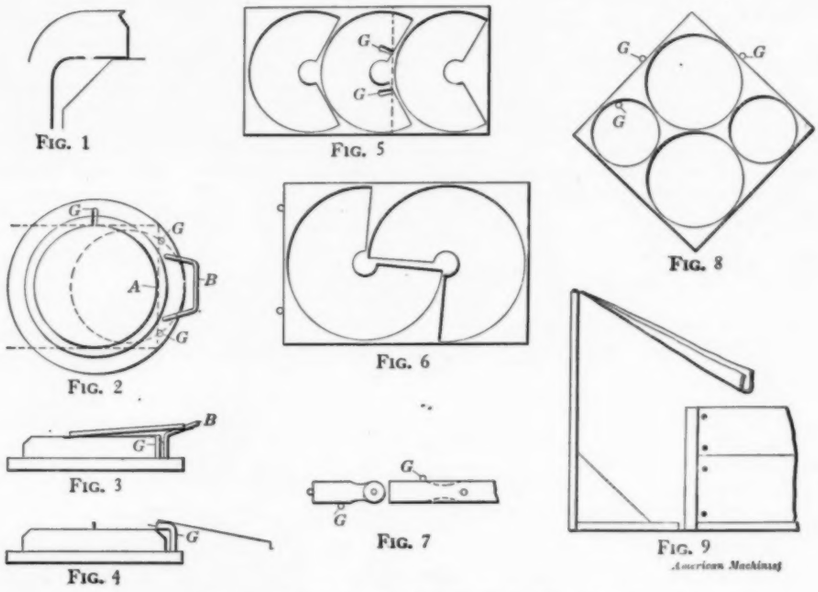


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7 Fig. 8 Fig. 9

Pointers on Stock Gages in Press Work

## International Industrial and Trade Exposition, Turin, 1911

Contrary to expectation, the preparations for the International Exposition, at Turin, Italy, have lately been taken hold of with such avidity at home and abroad, that the coming fair is likely to surpass the one held in Brussels last year. Of the space whose allotment has recently begun, comparatively little remains untaken. The total space covered by the fair grounds amounts to 12,000,000 square feet, of which 3,000,000 square feet—hence more than at Brussels—are occupied with buildings.

As is appropriate to the locality, the architecture follows the Piedmontese style of the Eighteenth century. All buildings are erected by the Italian government, and they are rented out to individual countries. The interior equipment is to be taken care of by the nations using it. Among the States which have applied for allotment are the following: Germany, 280,000 square feet; France, 230,000; England, 200,000; United States, 130,000; Brazil, 90,000; Belgium, 60,000; Hungary, 50,000; Switzerland, 37,500; South American Republic, 29,000; Japan, 23,500; Austria, 20,000; Servia, 6000; Persia, 5000; China, 5000, and Siam, 3500. The exposition is expected to open May 1.

# Increasing Shop Capacities

News items for the sales department — where more equipment will be needed. Authentic news is solicited for this department, not rumors or gossip — facts

## Metal Working

### NEW ENGLAND

The Blethen garage, Dover, Me., destroyed by explosion. Loss, $5000.

The Guyler Manufacturing Company, South Framingham, Mass., is to expend $40,000 on a machine shop.

The S. K. Merrill Company, Providence, R. I., manufacturing lockets, will double the capacity of its plant.

The Stoddard Union Company, Hillsgrove, R. I., is to remove its business to Taunton, Mass., into a new plant that will be erected.

The Gillett Vibber Company, New London, Conn., manufacturing electrical specialties, is erecting a new factory building, increasing its capacity.

The L. W. Pond Machine and Foundry Company, Worcester, Mass., is to expend $75,000 for a new addition to its foundry. The equipment will include three traveling cranes.

The Boston Aëro Company, Boston, Mass., has been incorporated to manufacture aëroplanes, etc. Capital, $100,000. Incorporators, E. S. Randall, F. L. Pigeon, F. W. Coughlin, etc.

The Safety Device Company, of Springfield, Mass., has been organized with J. W. Appley, formerly superintendent of the Sultan Motor Company, as general manager. The company will manufacture a safety auto crank and automatic nonoverflow funnel, and is in the market for small punch presses and other tools. Office is located at 129 Cambridge street, Springfield, Mass.

### MIDDLE STATES

The Leonard Sheet Metal Works, Hoboken, N. J., will erect a new plant.

Fire destroyed the plant of the Star Brass and Iron Bed Company, Brooklyn, N. Y.

The American Motors Company, Indianapolis, Ind., will erect an additional plant.

The Superior Gas Engine Company, Springfield, Ohio, will build an addition to its plant.

David Halstead is having a garage built at Green and Johnson streets, Phialdelphia, Penn.

E. G. Kolb is going to build a garage at Stenton and Gowen avenues, Philadelphia, Penn.

William J. Moss, of St. Johns, Mich., is building and fitting out a garage and machine shop.

The foundry of Wilder-Strong Implement Company, Monroe, Mich., was partially destroyed by fire.

Work has been started on a new plant for the Pittsburg Machine Tool Company, in Braddock, Penn.

Kahn & Greenburg are having a garage built at Twenty-third and Market streets, Philadelphia, Penn.

The American Can Company, Philadelphia, Penn., will erect a new factory at Beach and Palmer streets.

Robert Graves, of Mineola, L. I., will build a two-story garage at Fortieth street, near Park avenue, New York.

The Superior Gas Engine Company, Springfield, Ohio, is to erect a two-story addition to its plant during the summer.

The Northwestern Can Company, Chicago, Ill., will at once begin the erection of a large factory building at Brazil, Ind.

The Motsinger Device Company, Pendleton, Ind., manufacturing automobile sparkers, will move its plant to Lafayette, Md.

The Taylor & Boggis Foundry Company, Cleveland, Ohio, will build a new iron foundry and lock-manufacturing plant.

Fire destroyed the copper and tinplate factory of G. F. Ott, at 2 Buttonwood street, Philadelphia, Penn., causing a loss of $15,000.

Several new shop buildings will be erected at the plant of the Koppel Company, Koppel, Penn. The concern manufactures steel cars, etc.

Joseph Doan Company, roofers and cornice makers, is erecting a two-story factory at Eleventh and Olive streets, Philadelphia, Penn.

The Gramm Motor Car Company has moved into its new plant, at Lima, Ohio. Will erect three extensions and enlarge main building next fall.

The Acme Foundry Company, Indianapolis, Ind., has been incorporated with a capital of $10,000, by J. M. Haines, F. T. Taylor and J. L. Hall.

The Enterprise Foundry and Fence Company, whose factory burned recently, at Indianapolis, Ind., with a loss of $16,000, will rebuild at once.

The P. A. Coon Silver Manufacturing Company, 320 North Clinton street, Syracuse, N. Y., is in the market for machinery to equip a new factory.

Contracts have been let for a new plant for the Crouse-Hinds Company, manufacturer of electrical apparatus, at Wolf street, Syracuse, N. Y., to cost, approximately, $150,000.

Moline Pressed Steel Company, W. H. Powell, secretary, will double the capacity of its plant in East Moline, Ill. The capital stock has been increased from $25,000 to $50,000.

The Wheeler-Schebler Company, manufacturer of the Schebler carbureter, will build at once, a large automobile garage adjoining its plant at Shelby and Sanders streets, Indianapolis, Ind.

The Warner Manufacturing Company, Toledo, Ohio, making automobile parts, has made a further purchase of property on which it expects to erect factory buildings in the near future.

The Ohio Electric Car Company, Toledo, Ohio, manufacturing automobiles, has increased its capital stock for the purpose of making extensions. The company expects to build a new plant.

Jackson, Church & Co., of Saginaw, Mich., are building a new boiler shop, which will be equipped with traveling cranes, riveting tower and a complete line of machinery for the manufacture of boilers.

The York-Tinker-Kraft Novelty Company, Cleveland, Ohio, has been incorporated with $50,000 capital to manufacture all kinds of enameled articles, by David A. York, Charles F. York, Justus A. Tinker, etc.

The Davis & Siehl Company, Cincinnati, Ohio, has been organized to manufacture and sell fences and wire articles. Incorporators, J. Frank Davis, C. Fred Siehl, John D. Berger, etc. Capital, $30,000.

The W. S. Company, Newark, N. J., has been incorporated to manufacture hooks and eyes, buckles, electric webbing. Capital, $50,000. Incorporators, B. S. Sager, J. Freeman, Oscar Sager, L. Wilkinson.

Klubertanz Brothers, galvanized iron and tinware manufacturers, will erect a building and plant at Twenty-third and Fond du Lac avenues, Milwaukee, Wis. F. Wandree, architect, 77 Cawker building, Milwaukee.

The International Flexible Metal Hose Company, Newark, N. J., has been incorporated with $125,000 capital to manufacture flexible metal hose, couplings, nozzles, etc. Incorporators, L. V. Aronson, A. Harris, Fred Wilkie.

The Hoosier Sealing and Filling Machine Company, of Indianapolis, Ind., has been incorporated with a capital of $10,000 by Arthur O. Todd, Thomas and Norman Moss, to manufacture sealing and filling machines.

G. W. Wilkinson, owner of a factory in Montpelier, Ind., that manufactures automobile plows, will remove its plant to Muncie, Ind., and has purchased the buildings formerly occupied by the Crozier automobile works.

The Steel Products Company, of Columbus, Ohio, recently incorporated, has leased the plant of the Taylor Steel Company, at Plain City, Ohio, and will operate it in the future. The company will make steel castings almost exclusively.

The Bryant Heater and Manufacturing Company, Cleveland, Ohio, has been organized to manufacture and deal in gas-water heaters. Incorporators, Charles L. Bryant, Otto Fox, Bernard A. Hendrickson, etc. Capital, $50,000.

The Auto Specialty Manufacturing Company, Indianapolis, Ind., has been incorporated with a capital of $10,000, by A. T. Pursell, M. V. Wiggins, G. W. Dollarhide, F. E. Floyd and J. L. Floyd, to manufacture automobile parts.

The Superior Iron and Manufacturing Company, making gray and malleable castings, Toledo, has made application for authority to increase its capital stock from $50,000 to $100,000 to provide more working capital and make extensions to its plant.

### SOUTHERN STATES

The Kinston (N. C.) Iron and Mantle Works contemplate manufacturing a line of agricultural implements.

The Miller Manufacturing Company, South Richmond, Va., will build and equip a new machine shop in connection with its lumber plant.

The Trackless Trolley Company, Harpers Ferry, W. Va., has been incorporated with $100,000 capital to manufacture automobiles and motor vehicles. Incorporators, Loren N.

Downs, of New York; Hugh L. Kirby, Harpers Ferry, M. L. Montague, H. H. Emmert, Martinsburg, W. Va.

### WEST OF THE MISSISSIPPI

Albert Bechter, McIntosh, Minn., will erect a blacksmith shop.

Arthur Yendall, of Timber Lake, S. D., will erect a blacksmith shop.

H. K. Stroud's machine shop, on East First street, Hastings, Minn., was burned.

The Milan Metal Works, Milan, Minn. (Andrew Strid, owner), will erect a factory.

The United Railroads, San Francisco, Cal., have had plans prepared for new car shops.

The construction quartermaster, at Fort Stevens, Ore., is asking for bids for a blacksmith shop.

The Excelsior Wire Fence Company, Portland, Ore., is planning to erect a factory for its product.

The Standard Brass Casting Company, Oakland, Cal., has taken out a permit to erect a new foundry building.

M. J. Nolan, Los Angeles, Cal., will build a commercial garage. Modern repair machinery, etc., will be installed.

Fred Wilbert, Fremont street, San Francisco, Cal., has taken out a permit to erect a machine and blacksmith shop.

H. A. Starkey, Seattle, Wash., will build a commercial garage and repair shop. Modern repair machinery will be installed.

A. N. Davidson, Los Angeles, Cal., is having plans prepared for a commercial garage. Modern repair machinery will be installed.

The Beach Manufacturing Company, Portland, Ore., is planning to erect a factory for the manufacture of steel culverts at Kenton, Ore.

The Brown-Yale Company, Portland, Ore., has taken out a permit to erect a commercial garage. Modern repair machinery will be installed.

Geo. K. Darling, Los Angeles, Cal., is having plans prepared for a commercial automobile agency. Repair machinery, etc., will be installed.

H. E. Law, of Mason City, and R. A. Law, of Waterloo, have secured a site for the erection of a factory to manufacture vacuum cleaners at Charles City, Iowa.

The Berlin Machine Works, Beloit, Wis., manufacturing sawmill machinery, is planning to build a branch factory on the Pacific coast. Sites are being considered at Tacoma, Wash., and at Portland, Ore.

### CANADA

The Canada Wire and Cable Compny will build a big plant in Toronto.

The Positive Clutch and Pulley Works, Toronto, Ont., will establish a branch factory in Buffalo.

E. Van Acker, of Montreal, is head of the Belgo Canadian Steel Company, which will locate a big plant there.

## General Manufacturing

### NEW ENGLAND

Middleboro, Mass., contemplates erecting a municipal gas plant.

S. A. Woods Machine Company, Boston, Mass., will erect a new power plant.

The town of Jaffrey, N. H., will erect a municipal electric-light and power plant.

The Camden Street Laundry, Lawrence, Mass., was destroyed by fire. Loss, $10,000.

The school committee, Lynn, Mass., will equip English high school with sewing machines.

The Dunn Worsted Mills, Woonsocket, R. I., is to erect a large addition to its present factory.

The big box mill and factory of J. L. Brakett & Son, Portland, Me., was destroyed by fire.

The Housatonic Power Company will increase the equipment of its plant on South Norwalk, Conn.

The Mason Weaving Company is to remove its tape plant from Worcester, Mass., to Westboro, Mass.

The Cudahy Packing Company will open a plant in South Boston, Mass., on which $100,000 will be expended.

The plant of Bourgoist & Wheeler Box Manufacturing Company, Boston, Mass., was almost entirely destroyed by fire.

The Westport (Conn.) Water Company is planning improvements to its power station and proposes to duplicate the present equipment.

Fire at the substation of the Edison Electric Light and Power Company, on Homer street, Newton Centre, Mass., did $25,000 damage.

A power project has been organized in Springfield, Vt., with L. B. Dow, president. The concern is to be known as the Clarendon Power Company. The company plans building a power plant at Clarendon gorge in the spring.

### MIDDLE STATES

The Dayton (Ohio) Art Glass Company will erect a three-story factory.

The J. B. Thiery Piano Company, Milwaukee, Wis., will erect a four-story factory.

Extensive improvements will be made to the municipal waterworks plant at Coshocton, Ohio.

A. Albright & Son are erecting a box factory at Front and Chew streets, Allentown, Penn.

The Sanitary Can Company, Indianapolis, Ind., will spend $5000 in improving its power plant.

The Detroit (Mich.) & Suburban Gas Company is erecting a new two-story generator house.

The Grand Rapids (Mich.) Cigar Box Company will erect a new plant at 124 Ellsworth avenue.

The power house of the David Davis Coal Company, Conesville, Ohio, was burned. Loss, $10,000.

The Kellogg Corn Flake Company, Battle Creek, Mich., will erect a five-story factory building.

Fire destroyed the factory of the Jaynes Company, makers of insulating joints, Irvington, N. J.

The Holt Ice and Cold Storage Company, Indianapolis, Ind., will build an addition to its plant.

The Auburn (Ind.) electric-light and waterworks plant will install complete modern equipment.

The Huss Brewery, at Bangor, Wis., was destroyed by fire. Loss, about $50,000. Will be rebuilt.

The Corn Products Refining Company will spend $1,500,000 in enlarging its plant at Chicago, Ill.

The Lakeside Paper Company, E. J. Lachman, president, will erect a paper mill at Neenah, Wis.

The Citizens Heat and Light Company, of Elwood, Ind., will spend $100,000 in improving its plant.

Geo. Laub & Sons, Buffalo, N. Y., tanners, will erect a five-story addition to their plant on Clinton street.

The power and light plant of the Muskingum County Infirmary, at Zanesville, Ohio, will be improved.

Harvey Fibre Company is going to build a new factory at Allegheny and Janey streets, Philadelphia, Penn.

Fire destroyed the plant and grain elevator of the Calumet Grain Elevator Company, Chicago, Ill.

The Defender Photo Supply Company, Rochester, N. Y., will enlarge its power plant, doubling its capacity.

The Arctic Ice Cream Company, Detroit, Mich., is building a factory on Grand River avenue, near Ash street.

Claude & C. C. Lefter, Daleville, Ind., are planning to build a button factory; work on the building to begin early in the spring.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids March 21 for two turbo-generating sets.

The Ames-Bonner Company, manufacturer of brooms and brushes, 64 Ottawa street, Toledo, Ohio, will erect an addition in the near future.

The Stetson Hat Company, Philadelphia, Penn., is going to build two additions to its factory; one eight stories, and the other six stories.

Robert Jones, Sterling, Ill., will build a new two-story rug factory. New looms will be purchased; also other rug-making machinery.

C. J. Heppe & Son, piano manufacturers, are going to build an addition to their factory at Sixth and Thompson streets, Philadelphia, Penn.

The Denstew Hair Company is having a new engine house built, at the northwest corner of Ninth and Ontario streets, Philadelphia, Penn.

A franchise has been granted the Lake Geneva and Lake Delevan Electric Company to construct an electric railway in the city, at Delevan, Wis.

The New Bethlehem (Penn.) Fabric Manufacturing Company, J. H. Luke, president, has purchased a site for a factory and will build early in the spring.

The Eclipse Laundry Company, Zanesville, Ohio, has been organized with $50,000 capital to operate a laundry, by A. L. Rea, J. W. Frazier, J. F. Winchell, etc.

W. Freihofer has purchased a site for a theater at Frankford and Margaretta streets, Philadelphia, Penn., for which lighting and heating plant will be needed.

The Home Brewing Company, of Milwaukee, Wis., will build a $500,000 plant. Fred Gatterdam, architect, Chicago. Carl Hein, secretary, 319 Third street, Milwaukee, Wis.

The Box Company of America, New York, has been incorporated with $50,000 capital to manufacture boxes of all kinds. Incorporators, E. Kirk Haskell, G. Belgard, V. M. Forrest.

Hettrick Brothers Company, Hoag & Ferbwood avenues, Toledo, Ohio, manufacturer of awnings, belting and canvas goods, is preparing plans for the erection of a three-story addition.

Bids will be received by the board of public works, Mt. Clemens, Mich., and opened on March 3, for a 3,000,000-gallon pumping engine. Plans can be obtained from the office of the city clerk.

Cuyahoga Brick and Shale Company, Cleveland, Ohio, has been organized to manufacture and sell brick and shale products by R. J. Davidson, C. R. Cross, John D. Fachler, etc. Capital, $125,000.

The Wanda Furniture Company, of Cleveland, Ohio, has been organized with a capital of $25,000 to manufacture furniture. Incorporators, Felix Mayewski, Ignacy Klopezynski, T. Olszsynski, etc.

The Youngstown Carriage Company, Youngstown, Ohio, has been incorporated with $100,000 capital to manufacture carriages and other vehicles, by W. P. Williamson, C. A. Cochran, John Tod, etc.

The Marietta Mantle Company, Marietta, Ohio, has been formed to manufacture wooden mantles and furniture. Incorporators, F. M. Brickwede, Charles O. Brickwede, William W. Trout, etc. Capital, $50,000.

The Cleveland Rubber and Supply Company, Cleveland, Ohio, has been incorporated with $10,000 capital to manufacture and sell automobile parts and accessories, by M. J. O'Connor, R. A. Wilbur, A. Dale, etc.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids March 7, for 48 steam gages, brass cocks, pipe fittings, unions, valves (schedule 3363), chain hoists and blocks (schedule 3361), steel forgings, bar steel, machine steel (schedule 3362).

## SOUTHERN STATES

The Standard Paper Company, South Richmond, Va., is installing a new power plant.

Fire destroyed the box factory of L. M. Woolwine & Co., Memphis, Tenn. Loss, $45,000.

## WEST OF THE MISSISSIPPI

M. M. Klein, of Roundup, Mont., will erect a brewery.

Jordan Brothers, of Sioux Falls, S. D., will erect a planing mill.

The sawmill of V. S. Reed, Valley, Wash., was destroyed by fire.

The city of Newport, Ore., is planning to install a new sewer system.

The city of Phoenix, Ore., is planning to install a municipal water system.

Elov Erickson will erect a modern creamery at Eden Valley, Minn., next spring.

Geo. C. Roeding, Tehachapi, Cal., is installing a pumping plant on his property.

The Creamery Company, at Belmond, Iowa, will erect a $4000 creamery next spring.

The city of Glenns Ferry, Idaho, is planning to install an electric-lighting system.

The David Tozer Company, of Stillwater, Minn., will erect a power house, 35x80x17.

The city of Great Falls, Mont., is planning to make improvements in its sewer system.

The Canal Lumber Company, Seattle, Wash., will build an addition to its lumber plant.

The Hoquiam Packing Company, Hoquiam, Wash., will build an addition to its plant.

F. C. Stettler, Spokane, Wash., manufacturing paper boxes, will build a new factory.

The Douglas County Fruit Union, Roseburg, Ore., will build a new fruit-canning factory.

The San Diego Feed Mills Company, San Diego, Cal., will build an addition to its plant.

The Los Angeles Brewing Company, Los Angeles, Cal., will build an addition to its plant.

The Olympic Portland Cement Company will erect a $1,500,000 plant at Bellingham, Wash.

J. A. Woy, Tehachepi, Cal., will install a pumping plant on his property in this vicinity.

The Barber Asphalt Company, Portland, Ore., is rebuilding its plant recently destroyed by fire.

The city of Riverside, Cal., is contemplating the installation of a municipal water system.

The city of Medford, Ore., is planning to make improvements in its water and sewer systems.

The Danville Lumber Company, Danville, Wash., is planning to add new machinery in its mill.

The Union Ice Company, Los Angeles, Cal., has taken out a permit to build an addition to its plant.

The Christenson Lumber Company, San Francisco, Cal., will erect a dry-kiln addition to its plant.

C. D. Patterson, Neighbours, Cal., will install new centrifugal pumping machinery on his property.

C. L. Becker, Anaheim, Cal., is planning to install a pumping plant on his property in this vicinity.

The Home Gas Company, Porterville, Cal., will reconstruct its entire plant and double the capacity.

The cities of Marshfield and North Bend, Ore., are planning for a joint municipal water system.

H. Hammer, Bossburg, Wash., is planning to erect a cement plant in this vicinity to cost $500,000.

Oscar Buschmann, Juneau, Alaska, has purchased a site near Sitka, and will build a fish cannery.

The Mount Hood Railway and Power Company, Portland, Ore., will erect a power plant to cost $100,000.

The New Process Oil Company, Long Beach, Cal., is building a new refining plant on the west flats.

The Imperial Ice Company, Santa Monica, Cal., will build an addition to its plant. Plans are being prepared.

The Stockton Record Publishing Company, Stockton, Cal., is having plans prepared for a new printing plant.

The Braun Chemical Company, Los Angeles, Cal., is having plans prepared for an addition to its plant.

The American Disappearing Bed Company, Los Angeles, Cal., is planning to double the capacity of its factory.

Smith & Hill, of Mobridge, S. D., have applied to the council for a franchise to install an electric-light plant.

Bailey & Schmitz, wholesale upholsterers, Los Angeles, Cal., are having plans prepared for a new factory building.

The Standard Ice Company, Seattle, Wash., is planning for the erection of a new boiler-house addition to its plant.

E. M. Salisbury and M. C. Chafrey, El Centro, Cal., are planning for extensive irrigation work in this vicinity.

Murry Laidlow, Reno, Nev., is planning to build a factory for the manufacture of mattresses, at Klamath Falls, Ore.

W. W. Moore, Yoakum, Tex., is in the market for equipment for a new dry-press brick plant of 20,000 daily capacity.

Rafael Pardo, Mexico City, Mex., is planning to erect a power plant on the Santiago river, in the vicinity of Tepic.

The Pacific Light and Power Company, Los Angeles, Cal., will make improvements in its gas system at San Bernardino.

The Twin City Electric Company, Raymond, Wash., will soon commence the construction of an electric railroad.

The Inland Portland Cement Company, at Metalline Falls, Wash., will double the capacity of its plant about April 1.

The Adeline Consolidated Oil Company, Maricopa, Cal., is building a reduction plant for the manufacture of road oils.

The National Lumber Company, San Pedro (Los Angeles), Cal., has taken out a permit to build an addition to its plant.

The city of Santa Ana, Cal., will install a municipal water system to cost $20,000. Bonds for this sum have been voted.

The city of Lewiston, Idaho, is planning to expend $5000 on rotary pumping equipment for use on the Clearwater river.

The Yoerg Brewing Company, St. Paul, Minn., will erect a $50,000 bottling plant at Ohio and Ethel streets, St. Paul, Minn.

The Pacific Gas and Electric Company, San Francisco, Cal., is planning to increase the capacity of its gas plant at Chico, Cal.

The Stewart Fruit Company, Porterville, Cal., is building a new packing house. A full equipment of machinery will be installed.

The International Boiler Compound Company, Portland, Ore., is planning to build a factory for the manufacture of its product.

J. E. Culver, Long Beach, Cal., is planning to establish a large lumber plant in this vicinity. A box factory will also be erected.

The Sunset Publishing Company, San Francisco, Cal., will establish a new printing plant on Fourth street. Plans are being prepared.

The International Electric Company, Nelson, B. C., is planning to build a power plant on the Pend d'Oreielle river, in this vicinity.

Power-plant equipment will be required in the new hotel to be erected at Portland, Ore., by C. Lowengart. Estimated cost, $100,000.

Major Williamson, quartermaster's department, Fort Mason, Cal., is asking for bids on an addition to the present pumping station.

Cousin Brothers, Victoria, B. C., are planning for the erection of a woodworking factory. Mill-working machinery will be installed.

A. S. Byers, Pasco, Wash., is at the head of an enterprise for extensive irrigation work in this vicinity; 50,000 acres will be improved.

Power-plant equipment will be required in the new hotel to be erected by W. E. Bush, Fresno, Cal. About $150,000 will be expended.

The Gate City Ice and Precooling plant, San Bernardino, Cal., is making improvements and additions to its plant to cost about $40,000.

Power-plant equipment will be required in the new Lincoln high school to be erected at Portland, Ore. J. G. Turnebull, engineer, Portland.

The Searchlight Gas Company has been incorporated at San Francisco, Cal., by F. C. Egan and M. L. Cramer, with a capital stock of $100,000.

L. T. Gillett, Goldendale, Wash., is at the head of an enterprise for extensive irrigation work in this vicinity. About $100,000 will be expended.

The Farmers' and Merchants' Club, Calexico, Cal., is planning to establish an electric-lighting plant in connection with the city water plant.

The San Joaquin Light and Power Company, Fresno, Cal., is planning to install a number of electric pumping plants in the vicinity of Corcoran.

The Hunt Baking Powder Company, Minneapolis, Minn., has commenced the erection of a new plant on University avenue, near Twenty-fifth avenue.

The Wood Brewing Company, Los Angeles, Cal., has purchased property and will build a plant on Santa Fe avenue. Estimated cost of building, $15,000.

The Prairie City Artesian Water Company, Coulee City, Wash., is planning to install new irrigation machinery; new pumping plants will be built.

The Pine Creek Irrigation Company, Walla Walla, Wash., is planning for extensive irrigation work in this vicinity. About $400,000 will be expended.

The South San Joaquin Improvement Company, Modesto, Cal., has been granted a

franchise to build and operate an electric railroad in this city.

The council granted a franchise to the Dallas (S. D.) Light, Heat and Power Company to construct and operate an electric-light and power system.

A. L. Brewer and J. S. Lewis, Ogden, Utah, have been granted a franchise to construct and operate an electric-lighting, heat and power system in the city.

Hans Skillbred, manager of the cement works, at Kenyon, Minn., will erect a plant for the manufacture of cement blocks, hitching posts, monuments, etc.

The California Roofing and Supply Company has been incorporated at Los Angeles, Cal., by F. E. Spinkman and E. T. Wall, with a capital stock of $10,000.

The Times-Mirror Company, publishing the *Times*, Los Angeles, Cal., is having plans prepared for a new publishing building to replace that recently destroyed.

Power-plant equipment will be required in the new hospital building to be erected by the El Reposo Sanitorium Company, Los Angeles, Cal. About $100,000 will be expended.

A central power plant will be installed for the two high-school buildings to be erected at Fullerton, Cal. Plans are being prepared by architect N. F. Marsh, Los Angeles.

The Weston Irrigation Project has been organized at Weston, Ore.; William MacKenzie, president. The company is planning extensive irrigation work in this section.

Power-plant equipment will be required for the new addition to the Hotel Portland, Portland, Ore. About $300,000 will be expended. Emil Schacht & Son, architects, Portland.

Henry Berg, Jr., and Nate Metz, Marysville, Cal., have purchased the Live Oak and Encinal Light and Power Company, and are planning to make extensions in the system.

Power-plant equipment will be required for the new 11-story office building to be erected by I. N. VanNuys, Los Angeles, Cal. Morgan, Walls & Morgan, architects, Los Angeles.

Power-plant equipment will be required in the new office building to be erected at Victoria, B. C., by the Dominion Trust Company, Vancouver. About $135,000 will be expended.

The Valley Ice and Laundry Company, Hemet, Cal., will make extensive additions to its plant and increase its equipment. Ice-making and laundry machinery will be installed.

New power-plant equipment will be required for the addition to the department store of the Mottmann Mercantile Company, Olympia, Wash. About $35,000 will be expended.

The Randolph Fruit Company, Porterville, Cal., is planning to erect a new packing house in the Tulare district and one in the vicinity of Ducor. Both will be fully equipped.

The Curtis Power Boat Company, Milwaukee, Ore., has increased its capital stock from $10,000 to $100,000. The present factory will be enlarged and extensive improvements made.

The Butte County Mill and Lumber Company has been incorporated at Oroville, Cal., with a capital stock of $75,000. The company is planning for extensive operations in this vicinity.

The Randolph Fruit Packing Company of California will erect a large fruit-packing plant at Lemon Grove, near San Diego, Cal. The plant will be equipped with the most modern machinery for handling fruit.

The Monterey & Pacific Grove Telephone Company has been incorporated at San Francisco, Cal., by E. C. Gee, C. Bull and R. C. Smith, with a capital stock of $100,000. The company is planning extensive operations.

Power-plant equipment will be required for the new hotel to be erected at San Francisco, Cal., in the Mission district; estimated cost, $120,000. Plans are being prepared by architect A. G. Scholz, Sixteenth and Mission streets.

The Imperial Valley Oil and Cotton Company, El Centro, Cal., has increased its capital stock and will immediately commence the completion of its cotton-seed oil mill, started some months ago. About $100,000 will be expended on this plant; it will be fully equipped with all necessary machinery.

The Washington Water Power Company, Spokane, Wash. (D. L. Huntington, president), is planning extensive improvements. New machinery will be installed at the local substation, extensions made to local light and power systems, new cars and car barn for the Spokane street railway, and the installation of a new conduit system.

## CANADA

P. W. Gardiner, of Galt, is doubling his planing mill.

North Toronto will install an electric-lighting plant.

The Montreal Packing Company will locate a big plant at Montreal.

The Cotton Print Company will build a big new factory at St. Timothee, Que.

Kingston, Ont., will spend $13,000 for additional electric-lighting machinery.

The Lilloet Light and Power Company will locate a new plant at Lilloet, B. C.

The Dominion Cooperage Company is building a big new factory at Brigden, Ont.

Winnipeg, Man., is building a new power house and will buy new turbine engines.

The Alberni District Electric Light and Power Company will equip a big power plant at Alberni, B. C.

The big plant of the Jervis Inlet Lumber Company, at Ladner, B. C., wiped out by fire, will be reequipped at once.

The Standard Construction Company, of Montreal, will place $35,000 worth of stone-crushing machinery in a plant there.

John E. Stewart, of Andover, N. B., is head of a company which will develop electric power on the St. John river by installing a big plant.

The Saraguay Company, of Montreal, will place two 4500-horsepower turbines and complete equipment in a new power house it will build shortly.

The British Canadian Paper Mills Company, of Montreal, will equip several plants for manufacturing paper. Hon. T. H. Berthlaum, of Montreal, is the head of the company.

# MINING

The San Julian mine, Chihuahua, Mexico, is building an 80-ton milling plant.

The Predilecta mine, Durango, Mexico, will install new concentrating machinery.

The Julieta mine, Chihuahua, Mexico, will install a reduction plant in the near future.

The Zinc Smelter Company, Saltillo, Coahuila, Mexico, will build a new smelting plant.

The Santa Eduiveges mine, Sonora, Mexico, is planning to increase the capacity of its mill.

The Thariss York mine, Pilares, Sonora, Mexico, will install new compressor machinery.

The San Felipe mine, Hildago, Mex., is planning to install new electric hoisting equipment.

The Constancia mine, Las Sauces district, Parral, Mexico, will install new equipment at its mill.

The Nevada National Mining Company, operating at Round Mountain, Nev., will build a new mill.

The Inspiration Copper Company, operating near Globe, Ariz., will install an electric-haulage system.

The Treasure Mining and Reduction Company, operating at Mogollon, N. M., will install new drills.

Barney Osdick, operating a 5-stamp mill, near Randsburg, Kern county, Cal., will install cyanide equipment.

The L. C. Church Company, operating near Miami, Ottawa county, Okla., is installing a new pumping equipment.

The Spaulding-Clough property, Dome creek, Fairbanks, Alaska, will install a new boiler and hoisting equipment.

The Murchie mine, Nevada City, Cal., is planning for extensive development work; new equipment will be installed.

The Metallurgia Baja California Company, La Paz, Lower California, will install a 50-ton cyanide and filtration plant.

The Nighthawk mines, near Kingman, Ariz., operated by Fred Brawn and Fred Coolidge, will install new machinery.

The Perferdora Mexicana Company, operating at El Oro, Mexico, is building a power plant for operation of Buena Vista mine.

The Choix Consolidated Mining Company, operating in Chihuahua, Mexico, is building a new smelting plant of 100 tons capacity.

The Cochise Gold Company, operating in the Dragoon mountains, vicinity of Phœnix, Ariz., is planning to install a 500-ton cyanide plant.

The San Roberto mine, Zacatecas, Mexico, is contemplating the erection of a concentrating plant. Other improvements in the property will be made.

The Los Angeles mine, Parral district, Mexico, will install a 30-ton cyanide mill. Stallforth & Hermano, Parral, are principal owners of this property.

The Purissima mine, Hidalgo, Mexico, is overhauling its entire machinery equipment and making improvements. Cyanide equipment will be installed.

The Galena mine, Mina district, near Parral, Mexico, will undergo extensive alterations. Increased operations are planned and new machinery will be installed.

The Federal Mining and Smelting Company, operating at Mullan, Cœur d'Alene district, Idaho, is building an addition to its mill, increasing the capacity to 100 tons per day.

The Tom Reed mine, near Kingman, Mohave county, Ariz., is planning for extensive improvements. New power equipment will be installed, hoisting facilities and other machinery.

The Granby Mining and Smelting Company, operating at Prince Rupert, B. C., has bonded property on Copper mountain, vicinity of Phœnix, and will install diamond-drilling machinery.

The Palmarejo & Mexican Goldfields Company, operating in Chihuahua, Mex., is planning to build an aërial tramway, a large recovery plant and to fully equip its property with machinery.

Alexander Poison, of the Hoquiam Logging Company, Hoquiam, Wash., is planning for extensive operations of his coal mines at Glacier. The mines will be fully equipped with necessary machinery.

W. L. Shedd, Los Angeles, Cal., has purchased a controlling interest in a granite mine, near Boulder Wells, Mecca district, Cal.,

and is planning for extensive operations. It is planned to erect a stamp mill later.

The Carlotta and Pennsylvania mines, near Tuolumne, Cal., have been bonded by John Oleson, San Francisco, Cal. Extensive development work is being planned; the mines will be fully equipped with new machinery.

The Boundary Mining and Exploration Company, Phœnix, B. C., operating coal mines at Midway, will install a large plant for operation. Hoisting equipment, tipple and all other machinery necessary for permanent use will be installed.

The Mojave Mines, Inc., operating the Mojave mine, near Silver Mountain, San Bernardino, Cal., will install new equipment to the extent of $500,000. A 40-stamp mill will be erected at once, and this capacity increased before the close of the year.

The Pulaski Coal and Navigation Company has been organized at Los Angeles, Cal., by H. B. Guthrey, of this city, and others. The company controls over 300 acres of coal land at Coquille, Ore., and is planning for extensive work. The mines will be fully equipped with machinery: about $75,000 will immediately be expended.

## Business Items

The Westcott Chuck Company, Oneida, N. Y., has been awarded a gold medal at the Brussels Exposition of 1910.

Lapointe & Hall, Hudson, Mass., have been appointed the exclusive agents in the United States and Canada, for the Lubin & Weiffenbach special automobile machinery.

The Yale & Towne Manufacturing Company has been awarded the contract for installing a complete monorail overhead tramway system for the J. H. Ladew Company's new tannery, Plank road and Passaic river, Newark.

Hanford & Barkley, mechanical engineers and designers of special machinery, with general offices at Rochester, N. Y., have recently opened a branch office in New York, in the St. Paul building, 220 Broadway, and also one at 907 Penn building, Boston, Mass.

The new plant of the Fulton Machine and Forging Company, at Canal Fulton, Ohio, has been completed. This plant has a thoroughly equipped forging department, consisting of hammers, presses and fuel oil-burning furnaces and appliances used in the manufacture of drop and general forgings.

Lowenthal & Co., Buffalo, N. Y., have opened a branch in the Ford building, Detroit, Wis., in addition to their branches in Buffalo, Cleveland and Cincinnati. Their "ELCO" high-speed steel can now be obtained in Philadelphia through Barrett & Co., Witherspoon building, and in Boston through H. W. Hayes & Co.

## Forthcoming Meetings

The Cincinnati branch of the National Metal Trades Association will hold its annual meeting at the Business Mens' Club, Thursday evening, March 2.

American Supply and Machinery Manufacturers' Association, National Supply and Machinery Dealers' Association and Southern Supply and Machinery Dealers' Association; joint annual convention, Hotel Seelbach, Louisville, Ky., April 3-5, 1911. F. D. Mitchell, secretary, 309 Broadway, New York City.

National Metal Trades Association, annual meeting, April 14, 1911, New York City, Hotel Astor. Robert Wust, commissioner, New England building, Cleveland, Ohio.

American Foundrymen's Association, annual convention, Pittsburg, Penn., May 23 to 26, 1911. Richard Moldenke, secretary, Watchung, N. J.

American Society of Mechanical Engineers, spring meeting, Pittsburg, Penn., May 30 to June 2, 1911. Secretary, C. W. Rice, 29 West 39th St., New York City.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. S. Clark, secretary, 141 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Philip Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

Philadelphia Foundrymen's Association; meetings first Wednesday of each month, Manufacturers Club, Philadelphia, Penn. Howard Evans, secretary, Pier 45 North, Philadelphia, Penn.

# WANTS

*Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care, 505 Pearl Street, New York, will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.*

## Miscellaneous Wants

Caliper catalog free. E.G.Smith, Columbia, Pa.

Test indicators. H. A. Lowe, Cleveland, O.

Wanted—Work for turret lathes and gear cutter. Box 222, American Machinist.

We buy or pay royalty for good patented machine or tool. Box 282, Amer. Machinist.

Wanted—Work for screw machines and gear cutter. Box 775, American Machinist.

Wanted—100 spring motors, about 15 lb. capacity. Merchants Supply Co., Kansas City, Missouri.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Wanted—Contract work or medium weight specialties to build. Wm. A. Cather, Pottsville, Penn.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Wanted—Light and medium weight special machinery, jigs and fixtures, punches and dies, etc., to build to order. Box 520, Am. M.

Wanted—To purchase established general machine shop in live town of 5000 to 10,000; give name of banker. Box 457, Am. Mach.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Agency for machinery and tools, covering Pittsburg district, is wanted by well known and established engineer. "Engineer," Box 491, American Machinist.

Wanted—An article to manufacture suitable for the railway, automobile or hardware trade; must be patented and exclusive. Address Box 356, American Machinist.

Send broken cast iron parts for repair by oxy-acetylene welding at one-fourth cost of new ones; pay after you test them. Waterbury Welding Works, Waterbury, Conn.

Light and medium weight machinery and small parts in quantities; also screw machine and punch press work, tools, jigs, dies and high grade machinery. The Elgin Tool Works, Elgin, Ill.

Tools, dies, jigs and light and medium weight machinery designed and built to order; duplicate parts, either machined or die cast. Precision Die Casting Co., 422 So. West St., Syracuse, N. Y.

Large English firm of machine tool importers having showrooms and offices in Great Britain, France, Germany, Italy, India and Japan is wanting good agencies for machine tools of all kinds. Box 189, Amer. Mach.

Cummings Machine Company, 238 William street, New York. Estimates given on automatic machinery, bone hardening, grinding and jobbing; uptodate plant; highest grade work done with accuracy and despatch. 'Phone 5592 Beekman.

Welding by oxyacetylene process; special attention given to repairs of machinery and castings of all kinds; large experience in difficult experimental work; structural shapes welded together. Write for particulars. Krajewski-Pesant Company, 54 Beard St., Brooklyn, N. Y.

Manufacturer of telegraph machines, adding machines, taxameters, accurate interchangeable parts, dies and special tools, invites orders for similar special manufacturing. The Universal Telegraphic Company, Successors to the Rowland Telegraphic Company, Baltimore, Md.

Wanted—Partner with $5000 to invest in well established business; one who is not afraid of work; must be either a good mechanic, or a good business man; this will secure a one-fourth interest in a $30,000 corporation; year's work on hand. Box 519, American Machinist.

We operate a well equipped machine shop for all kinds of accurate work; we assist in developing ideas or designing machinery to accomplish certain results, overcoming imperfections in construction or design; we invite correspondence; estimates furnished; prices reasonable. E. V. Ballard Company, 18 Frankfort St., New York City.

European Business — Competent business man, well posted and acquainted in machinery business, also acquainted throughout Europe, wishes to represent or attend to foreign business for a few manufacturers; expect to make a trip soon and visit all important cities of Europe; highest references. Address "W.," American Machinist.

Wanted—Factory location; we are looking for a new factory location for our machine shop and foundry; we build heavy machinery and must have a side track and buildings suitable for electric traveling cranes; any factory sites or buildings that any city or commercial club has to offer will be considered. Bertsch & Co., Cambridge City, Ind.

Do you want machine work? Concern with live and well equipped office in metropolitan city, maintaining a competent sales force and engineering staff, now in alliance with one contracting machine shop, has surplus of orders and desires to form another alliance for the manufacture of its constructions; these units, averaging two and a half to four hundred pounds, are essential elements of automobile construction, are marketed in large lots and demand quantity production from accurate jigs and fixtures and modern machine tools; we have a half million of business to place this year on orders from responsible purchasers, and we possess every facility and ability required to increase this amount; we do not need financing and will not finance. We will not entertain an alliance with any but thoroughly wide awake manufactories whose finances, integrity and capacity or ability to increase capacity are unquestionable. Box 527, Amer. Machinist.

## Help Wanted

*Classification indicates present address of advertiser, nothing else.*

CANADA

Draftsmen, experienced on gun, typewriter or sewing machine tool and fixture work; men with shop experience preferred. Box 477, American Machinist.

Wanted—Speed boss for machine tools in a large electrical factory; must be thoroughly competent. Applicants state age, experience, salary expected. Apply Canadian General Electric Co., Peterborough, Ont.

CONNECTICUT

Wanted—Working foreman for a blacksmith shop of four or five fires, one understanding annealing and case hardening; good wages and steady work to the right man; shop in Connecticut. "A. B. C.," Am. Mach.

Wanted—Foreman for drop-forging department, by an old established company located

in the East; applicant must have had experience and ability to handle men; age not over thirty-five years; department in question operates about fifty hammers, making automobile and all descriptions of drop forgings; a live man required having ability to produce quality and quantity; applicant must furnish references with application and state salary expected. Box 537, AMERICAN MACHINIST.

ILLINOIS

Draftsmen—For tool drafting work; we need men who have had experience as designers on punch and die or jig and fixture work; in answer, state fully your experience along this line of work, salary desired and how soon you could report. Address Department 1056, Western Electric Co., Chicago.

MARYLAND

Wanted—Toolmaker, familiar with small subpress and jig work; must be capable of managing tool department. Box 545, AM. MA.

MASSACHUSETTS

Wanted—One designer on light semi-automatic machinery, and one experienced draftsman. Apply to Hobbs Mfg. Co., Worcester, Mass.

Wanted—Traveling man visiting machinery manufacturers to carry our goods as a side line; easy sellers; samples take no more room than a good sized pocketbook. "T. M.," Care AMERICAN MACHINIST.

Wanted—Toolmaker foreman, experienced in making up cutting tools and in die, jig and fixture work as used for quantity production of small interchangeable parts; only man with experience in foremanship of large tool shop need apply; state age, references, salary expected; give detailed reports of experience. Address "Foreman," Box B, Springfield, Mass.

MICHIGAN

Wanted—At Jackson, Mich., draftsman, experienced on axle, transmission and general gear work; state full particulars in first letter. Box 549, AMERICAN MACHINIST.

NEW YORK

Wanted—Working foreman to take charge of a tool room employing from six to ten men; kindly state experience and age, also wages desired. Box 563, AMER. MACHINIST.

Wanted—Experienced draftsman and tool designer to lay out dies and jigs for light manufacturing; state experience and salary. Columbia Typewriter Co., 37 West 116th St., New York City.

Wanted—Live young man, experienced in cost keeping and shop practice, for large plant located in city of 20,000 inhabitants; good position for right man; state age, experience and salary expected. "Manufacturer," AM. M.

Wanted—Machine tool salesman to travel out of New York to make a specialty of one line only; one with some shop experience preferred; good chance for right man; state salary and experience. Box 548, AM. MACH.

Wanted—Superintendent for long established company manufacturing machine tools of high grade; must be competent to take full charge of machine shop and foundry and direct the designing of special fixtures and new tools; state fully, experience, education, age and salary. Box 513, AMER. MACHINIST.

Wanted—Expert designer and experimenter to develop new machinery; shop experience and originality absolutely essential; knowledge of glass manufacture, automatic machinery and with technical training desirable; give present connection and past experience fully, and they will be treated as confidential; new firm, new undertaking; excellent opportunity. Address "Glass," AMER. MACHINIST.

NORTH CAROLINA

Wanted—Die machinists, experienced in making dies for forming and drawing decorated tin; steady and permanent employment, at good wages, in a progressive southern city, situated in the healthful Piedmont climate of North Carolina. Address with references, Drawer No. 36, Winston-Salem, N. C.

OHIO

Wanted—First-class lathe hands; state age and experience. The Heisler Co., St. Marys, O.

Wanted—Man between 25 and 35 years, to act as chief inspector in a machine tool plant; must be capable of formulating and perfecting complete inspection system; capable not only of detecting mistakes, but suggesting and applying the remedy; good salary to right man. Box 536, AMERICAN MACHINIST.

Wanted—A man having both technical and practical experience to take charge of a night school for our employees; during the day the instructor will spend part of his time in drafting room or tool room work; give full information in regard to qualifications, state salary expected, etc. Send reply care Box 538, AMERICAN MACHINIST.

Wanted—First class machinists, toolmakers, die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood and metal patternmakers, brass polishers, buffers, finishers, millwrights, hammermen and blacksmiths, who wish to increase their opportunities, to register with the free Employment Department of the National Metal Trades Association, New England Building, Cleveland, Ohio.

PENNSYLVANIA

Technical graduate, not over 28 years of age, with one or more years machine shop experience for position as tool steel salesman. Address Colonial Steel Co., Pittsburg, Penn.

Wanted—A technically educated, economy and efficiency expert, in a high-speed machinery manufactory, employing about four hundred mechanics, near Philadelphia. Box 550, AMERICAN MACHINIST.

Draftsmen and detailers wanted; applications solicited from those with small tool, jig and fixture experience on small interchangeable parts; state fully, experience, education, age and salary expected. Box 535, AM. MA.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WISCONSIN

Wanted—Men familiar with time study work and rate setting, in factory handling sheet brass work; give age, experience and salary expected in reply. Box 552, AM. MA.

Wanted—By one of the largest manufacturers in the country, a strictly high grade cost man, thoroughly familiar with the handling of manufacturing costs; university man preferred. Box 539, AMERICAN MACHINIST.

FOREIGN

Wanted—Machine shop foreman who is uptodate in modern steam and water boilers and radiator manufacturing; must understand the business thoroughly and be wide awake; good opportunity for young, energetic Scandinavian wishing to go to Sweden; advise age, experience, present and past employment; give references; only sober and competent man will be employed. Address "H 311," S. Gumaelii, Annoncebureau, Stockholm, Sweden, t. b. f.

# SITUATIONS WANTED

*Classification indicates present address of advertiser, nothing else.*

CONNECTICUT

Experienced tool and die maker wants position as foreman, with buckle or novelty manufacturer; employed, but wishing a change; age 38. Box 546, AMER. MACHINIST.

By young man, twenty-one years of age, who has completed draftsman's course in the International Correspondence Schools, willing to start on small wages. Box 560, AM. MA.

Superintendent, now in charge of plant producing high grade machine tools; nine years in charge of large shops; capable of producing large output economically; prefer plant building machine tools or fine interchangeable parts. Box 542, AMER. MACH.

A man of experience desires a position with either the manufacturing, maintenance or equipment departments of a manufacturing establishment where he can turn to advantage his knowledge of steam engines, boilers, electrical machinery, machine tools or power transmission machinery, and a demonstrated ability to handle men. Box 543, AM. MACH.

MAINE

Draftsman, age 30, technical graduate, shop experience, executive or drafting position. Box 534, AMERICAN MACHINIST.

MICHIGAN

Foreman, expert knowledge of steel treating, uptodate methods for carbonizing, hardening, tempering and machine blacksmithing; high speed steel a specialty. Box 556, AM. M.

Wanted—By general foreman, position as shop superintendent; 22 years at the trade; experience, gun work, automobile factory, manufactory plant, and projectile shop, piece work, high speed steel and handy man; have had charge of men for the past 12 years; references; now employed. Box 540, AM. MA.

NEW JERSEY

Mechanical superintendent for many years and at present well connected; rare practical shop experience; A-1 designer; technical; mechanical engineer. Box 673, Burlington, N. J.

NEW YORK

Expert draftsman, designer, special machinery wants to change. Box 561, AM. MACH.

Mechanical engineer, graduate, ten years' designing and shop experience, best references, desires change. Box 559, AM. MACH.

First class tool and case-hardener; 12 years' experience at gas, oil and coal furnaces; best of references. Box 544, AMER. MACHINIST.

Wanted—By foreman, successful in producing first class work at satisfactory cost in gasolene and fuel oil engine, desires change. Box 508, AMERICAN MACHINIST.

Uptodate machine shop foreman desires change; wide experience on tools, jigs and general manufacture; good executive; first class references. Box 555, AMER. MACHINIST.

Foreman, 34, at present employed, desires change; high inventive ability; medium or heavy work, electrical or general machinery; references from present employer. Box 517, AMERICAN MACHINIST.

Superintendent or manager, thoroughly competent; economical methods; general machinery and castings; also pump manufacturing; highly successful with men; good executive. Box 553, AMERICAN MACHINIST.

Mechanic, experienced in all kinds of machine engraving, such as numbering machines, dating, recording, etc., also steel and brass type of every description, is open for engagement. Box 558, AMERICAN MACHINIST.

Machine designer and mechanic with 14 years' experience, desires change; capable of designing and getting out special machinery or motor cars from ideas furnished; New York City preferred. Box 547, AMER. MACHINIST.

Representative, eighteen years' experience, good office, stenographer, salesmen, room to show goods, desires to sell products of responsible uptodate concern on commission; centrally located, New York City; best of references. Box 541, AMERICAN MACHINIST.

Mechanical engineer, with 18 years' experience in general machinery, power plants and equipment for industrial works, will be open for engagement May 1, desires position as superintendent of shops or New York City representative of works. "Capable," Box 510, AMERICAN MACHINIST.

Machinist, German, master mechanic with A-1 references as to character and capabilities, 42 years of age, 26 years' practical and theoretical experience as draftsman, experimental worker, tool and die maker, automatic machinery and interchangeable work, also foreman and superintendent knowledge, wants position as foreman or any responsible situation in any part of the United States. Box 557, AMERICAN MACHINIST.

PENNSYLVANIA

Experienced tool dresser and steel hardener. Box 562, AMERICAN MACHINIST.

Mechanical engineer seeks position as master mechanic or superintendent; seventeen years' varied experience; uptodate on modern methods; good organizer and systematizer. Box 526, AMERICAN MACHINIST.

Mechanical engineer and designer, experienced on typewriter, adding machines and the like, special automatic machinery and tools, specialist in experimental design, a heavyweight, is open for engagement with a progressive firm. Box 551, AMER. MACHINIST.

Man, 27, ambitious, desires position with manufacturing concern that will be progressive, with good future prospects; experience: drafting, patternmaking, office man and correspondent (typist), good education, clean character, executive ability; prefer location in Philadelphia vicinity; reference. Box 502, AMERICAN MACHINIST.

SOUTH DAKOTA

Metal patternmaker wants position with firm requiring close and exact work. Box 485, AMERICAN MACHINIST.

# FOR SALE

For Sale—Various lots of high speed metal slotting saws and cutters, all special sizes; send in your specifications; can make very attractive prices. Stewart & Clark Mfg. Co., Chicago.

For Sale—32 horsepower and 14 horsepower Backus gas engines, line shaft and other equipment; Bliss No. 30½ combination back geared and direct drive punch press; all of the above machines in the best of condition; can be seen at any time. Ellis Adding Typewriter Co., 204 Morris Ave., Newark, N. J.

An opportunity to start a machine shop; we offer one of our departments for sale, the one used to establish our business; it is small and profitable work, but as we are devoting ourselves to heavier work, we offer to sell for $2000, all the drawings, patterns, and stock of finished and partly finished parts and rough material (inventories over $3000), circulars, electrotypes, special machinery and fixtures, and an established trade. Address Sipp Machine Company, Paterson, N. J.

# Talks With Our Readers

*By The Sales Manager*

In the *Saturday Evening Post* not long ago there appeared a story describing the struggle of a number of Mississippi planters to keep the levee, which protected their property, from breaking.

Day and night they patrolled the embankment, watching for leaks.

Whenever a soft spot was discovered, where the rising water oozed through, the alarm was raised and help was immediately sent to strengthen the weak section. Sacks of earth were thrown in and then, just as the repair was completed, a fresh cry would be raised from some point further up or down the line and reinforcements would be rushed to the new danger point.

Relaxation meant the wiping out of lives and property.

Across the river, where the banks of another plantation ran down to the water's edge, the same scene was being enacted. And as they toiled, each group of workers watched the other, secretly hoping that the opposite bank would go first.

As a matter of fact both levees held. Close watchfulness and sacks of sand saved the day.

This illustrates a great truth.

In the machine-making field, as in other lines, one of the secrets of success is watchfulness—

Watchfulness against excessive costs—

Watchfulness against wasted material and effort—

Watchfulness against the hundred and one little profit leaks in the shop, which, if allowed to continue, will swell to serious proportions.

The safe, efficient and economical running of a shop is the levee which every progressive man in the shop should constantly patrol. When he finds a weak spot he should strengthen it himself, or if the breach is too big he should send for reinforcements in the shape of some device or piece of equipment which will mend the break and render that point stronger than ever.

And here is where your intelligence and resourcefulness comes in.

To the Southern planters all bags of sand are alike and will accomplish the desired results equally well, but you know that each sign of trouble in your shop, or attempt at betterment, requires different treatment.

The only way you can keep up to date on the improvements being made in machine shop machinery is by reading your technical paper and by studying the various advertised articles.

Across the bank is the other machine shop owner and men guarding their own levee and hoping that if something breaks it won't be on their side.

It's a case of the weakest going first. The strongest man is the one who not only detects the soft spots in his embankment, but who possesses a ready and accurate knowledge of what reinforcements to shove into the breach.

Guard your levee!

* * *

*Only reliable products can be continuously advertised.*